Design News

Bonded dry-film lubricates tapered plug valves. Page 22

A CAHNERS PUBLICATION

DECEMBER 8, 1961

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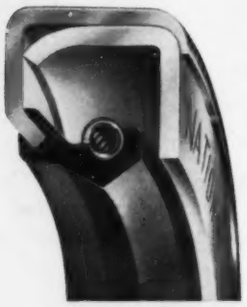

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Design News

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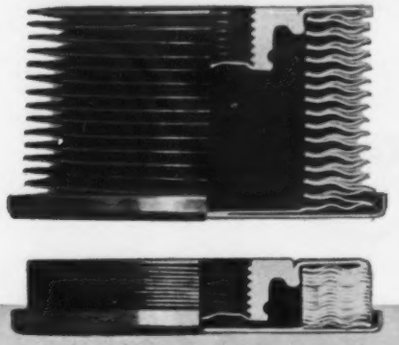

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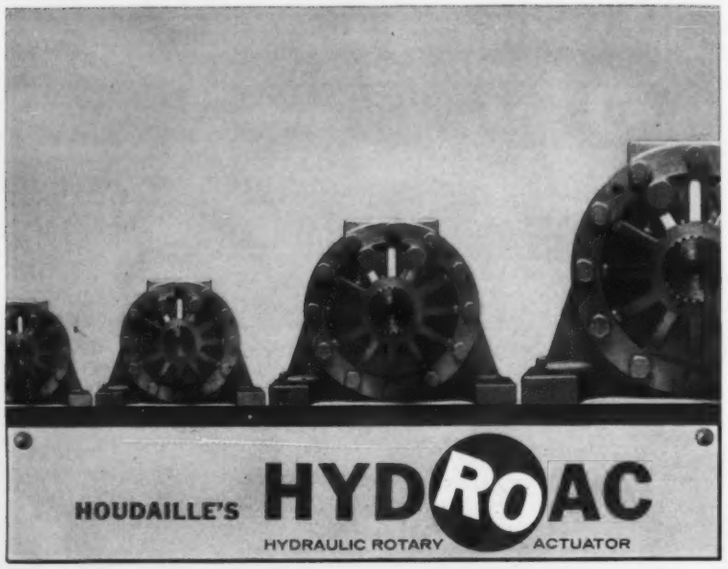

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SOUNDING BOARD

FOR OUR READERS

Metric System

I would like to express my appreciation to Louis B. McLellan for his letter to Sounding Board published in the Sept. 1 issue of DESIGN NEWS and his comments relative to my letter (calling attention to Mr. James Roosevelt's bill HR269) published earlier in this same column.

Mr. McLellan pointed out that the metric system was legalized by the U. S. Congress in the year 1886. It might be well to add, also, that this is the only measuring system which has been legalized by the U. S. Congress, as was pointed out by Mrs. Neuberger in the Congressional Record, Vol. 107, No. 101, in the Proceedings and Debates of the 87th Congress, June 16, 1961. Further, it is interesting to note from Mrs. Neuberger's comments that our English system of measurement is, in fact, referenced back to the legalized metric system as the means for determining our present standards.

It should be understood that Mr. James Roosevelt's bill HR269 was introduced to provide a means to authorize a study into the practicability and desirability of the U. S. adopting the metric system. Even though the metric system was legalized in 1886, unfortunately it has not received broad enough adoption by the federal government and industry to make it the main system of measurement in the U.S.

Another acceptance of the metric system took place Apr. 8 of this year when the Army adopted plans to change from the yard to the meter in making linear measurements for its weapons and related equipment.

R. M. MEHL
Chief Engineer
McClintock Mfg. Co.
802 W. Whittier Blvd.
Whittier, Calif.

• Readers interested in furthering the cause of the metric system can help materially by joining The Metric Assn., Inc. Dues are only $1 per year, payable to F. J. Helgren, Secretary-Treasurer, 2004 Ash St., Waukegan, Ill.

Thermocouples

We were very pleased with the Special Report in DESIGN NEWS issue of Sept. 15, 1961, particularly with the generous use you made of the information we supplied.

We should like to bring to your attention the fact that your Fig. 1 and Fig. 2 in the article were direct reproductions of our copyright literature, that while we have no objection to your printing these two figures we would like to have received credit such as that given to Baldwin-Lima-Hamilton at the bottom of page 4.

L. SCADRON, President
Aero Research Instrument Co., Inc.
315 N. Aberdeen St.
Chicago 7, Ill.

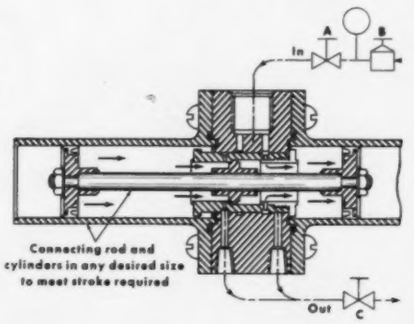
• Pardon our omission.

Reciprocating Linear Actuator

This Oct. 4, I opened up a new company by the name of Brammenco Industries. The capital behind this enterprise is a working model of a reciprocating engine and a patent dealing with a revolutionary ship-propulsion system.

I made a cross-sectional drawing to show the operation of this unit.

A. G. BASTIAANSE
Brammenco Industries
Box 264
Unionville, Conn.



Rocker-Arm Suspension

Re: Oct. 27, 1961, issue, pp. 90 and 91.

I reviewed with interest your article on the new 221-cu-in V-8 engine. In particular the valve arrangement shown on page 91.

It seems to me that the Chevrolet V-8 engine introduced the same sort of valve arrangement in 1955. My experience indicates that this sort of valve rocker-arm suspension is undesirable from a maintenance and wear standpoint as there is no side support to prevent rocker arm cocking and interference wearing which will result in failure of the stud. Also replacement studs must be oversized for a press fit into the cylinder head and a maximum of three replacements is all that can be undertaken.

If this suspension were good for the consumer, why do many cab fleets and stock car racers insist upon rocker arm shafts? It is understandable that the manufacturer desires to reduce fabrication and assembly costs, but this should not be done at the expense of the consumer. Perhaps the Ford Motor Co. should comment on what qualifying tests indicated with respect to reliability of this "new" rocker arm suspension.

PHILLIPP J. QUEDENS
Asst. Project Engineer
Chandler Evans Corp.
West Hartford, Conn.

Old Laws — New Problems

With increasing frequency, comments are being heard about the many problems involved in working with or for the federal government. Industrial leaders are becoming concerned about the large amount of government participation in industry. Government people are complaining about difficulties they have in working with industry.

One of the most intelligent comments I have read for some time on this problem is included in a speech by Donald W. Douglas, Jr., President of Douglas Aircraft Co. Mr. Douglas says, "There can be no question about requiring industry, in working for the government, to follow basic precepts laid down by our elected representatives in Washington. But we are entitled to explore realistically the best means to achieve this. . . . It does not take a very good ear to pick up growls of industrial discontent about how deeply government is getting into business. But talk about 'social reforms' is cheap while valuable solutions to the problem come a little harder . . . we must make up our minds whether we regard defense industry as truly private enterprise, quasi-public or what?"

Mr. Douglas goes on to suggest that we have a large number of related problems here that will have to be solved by co-ordinated efforts in both industry and government.

The major problems involved, I think, are those having to do with proprietary rights of private and corporate entities, the sheer size of industries needed to furnish complete weapons systems and the antiquated laws we have on the books which pertain to government-industry relations. During a recent press conference with President Kennedy, I had the distinct impression that the administration wants desperately to improve relations between government and industry. I also had a very strong impression that government servants in Washington are doing their level best to wade through the morass of antiquated procedures which face them at every turn.

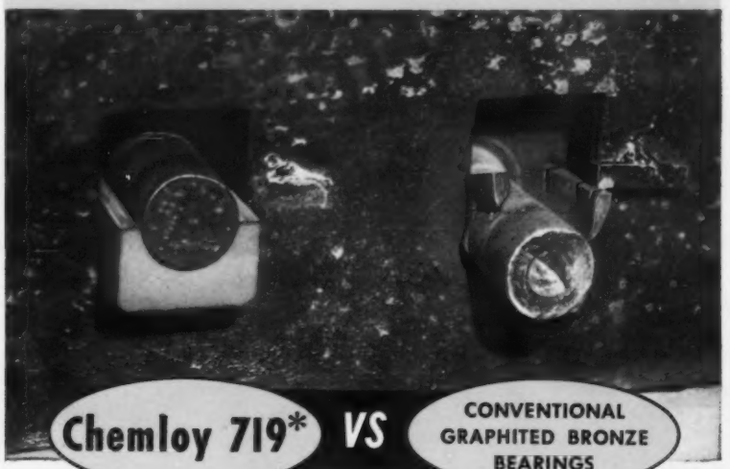
Why can't we have more face-to-face meetings between leaders on both sides of the government fence? Why not work out the necessary changes to our laws together and give Congress some concrete, well-thought-out solutions to these many problems?

This is 1961 — not 1861. Let's act accordingly.

J. F. Dubois

Executive Editor

OVER 5 TIMES THE LIFE OF GRAPHITED BRONZE BEARINGS



This report comes from the insulating board division of a large paper company where Chemloy Dry Bearings are outlasting, outperforming and saving money over conventional graphited bronze bearings. They are used to support rollers turning continuously in kiln dryers where lubrication is not practical or possible. Operating temperature is 350°F., bearing loads approximately 25 psi. Figures based on a 3-year service record indicate a yearly savings of $6,000.00.

Here are the facts:

1. Chemloy Bearings will last more than 8 years, as against an 18 month life expectancy for graphited bronze.
2. Chemloy's lower coefficient of friction eliminates retainer strips and weldments required for each bronze bearing installation.
3. Reduction of stub shaft wear due to bearing failure.

   Plus increased safety to personnel and equipment through elimination of hazardous welding of retainer strips in a dust-laden atmosphere.

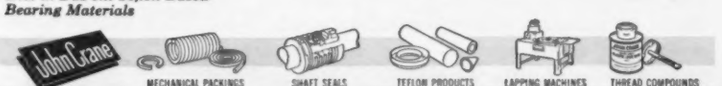
Put Chemloy 719 to work for you. Send b/p or specs. for engineering recommendations. Request Bulletin T-120 and price sheet on sheet, rod and tubing.

Crane Packing Company, 6423 Oakton Street, Morton Grove, Ill. (Chicago Suburb). *In Canada: Crane Packing Company, Ltd., Hamilton, Ont.*

Chemloy Bearings in action. Weld marks at left show positions of retainers formerly needed to keep bronze bearings in position. 20,000 such weldments are eliminated in this instance.

*Chemloy is an exclusive engineered product of Crane Packing Co. It is the result of extensive research and development to produce a better bearing material.

*Best in DuPont Teflon Based Bearing Materials



CRANE PACKING COMPANY

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DESIGN SPECIAL REPORT NEWS

Design Applications of Reversing Pumps

E. H. Schanzlin, Chief Engineer,
Tuthill Pump Co., Chicago, Ill.

Occasionally it is necessary to use a reversing pump either for hydraulic, coolant, transfer or other services. A smart designer can make use of these units to solve other tough design problems at the same time. Ease of installation or maintenance, the elimination of expensive components such as hydraulic valving or the reduction of inventory costs often can be accomplished.

A true reversing pump must fulfill certain requirements. It must be capable of operating from a shaft which may be driven in either direction and port positions must remain constant without elaborate valving or external equipment.

We only will consider pumps for small capacities from about 1/2 to 200 gpm and relatively low-pressure applications (to 300 psi). This includes a wide variety of everyday applications such as pressure lubrication pumps, coolant pumps, low-pressure hydraulic applications and other miscellaneous transfer and process equipment uses.

Advantages

1. Pump operates from reversing shaft. It is often convenient to drive a pump from a shaft subject to constant changes in rotation. A reversing pump can be driven, for example, from a member used to reciprocate a table on a milling machine or from the driving member of a drill press or lathe.

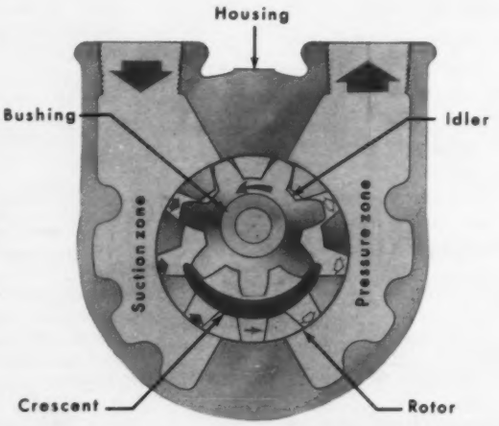
2. A reversing pump can be used when direction of rotation is unknown. In some pieces of equipment it is not possible to tell the ultimate direction of rotation of a driving member when the product is shipped from the factory.

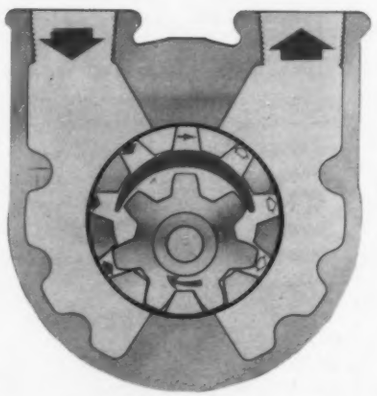
3. Pumps can provide simplified maintenance and installation. Reversing pumps can be used when the direction of rotation of the motor is opposite that anticipated or when some convenient shaft member must be selected to provide power to drive the pump. Field selection of any rotating shaft and the elimination of right- or left-hand problems in orienting the pumps is very useful.

4. Reversing pump is not subject to "kick-back" damage. Reversing pumps can often prove a boon in applications where "kick-back" is encountered. In many situations some sort of back pressure will cause the unit to rotate, even for a short time, in a direction opposite to that for which it was designed. This situation is found in scavenger pumps in diesels, large blowers and in pumps in water systems. Even a short-duration "kick-back" when using conventional pumps could be quite serious and result in damage to the equipment. Reversing pumps, of course, eliminate this possibility of trouble.

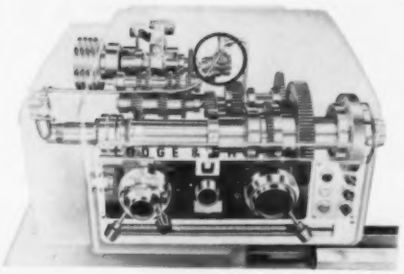
5. Inventory is reduced. The elimination of the need for carrying two separate unidirectional pump stocks presents an extra dividend. The amount of this savings depends on what the cost of carrying an item in inventory will be. We are told by accounting people that this amounts to roughly 18 percent of an item's cost per year.

Complete information on size determination and other installation and operating information are included in the standards of the Hydraulic Institute covering centrifugal, rotary and reciprocating pumps. Copies can be obtained from the Hydraulic Institute, 122 E. 42nd St., New York 17, for $6.

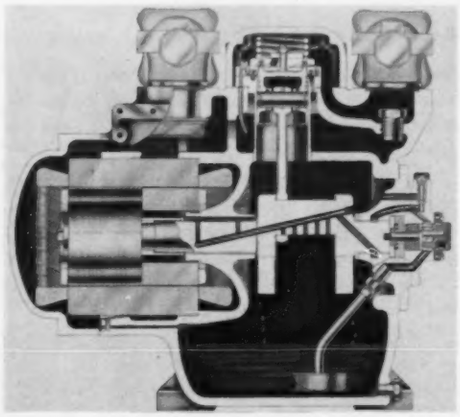




REVERSING PUMP contains key elements of rotor, idler gear and crescent-shaped partition. When power is applied in counterclockwise rotation to rotor, it is transmitted to idler gear by engagement of gear teeth. Space between OD of idler and ID of rotor is sealed by crescent. As pump is started, increase in volume as teeth come out of mesh creates vacuum, drawing liquid into pump through suction port. Liquid fills spaces between teeth of idler and rotor and is carried past crescent to pressure side of pump. As teeth mesh again, liquid is forced from spaces through discharge port. Reversal of shaft rotation from counterclockwise to clockwise causes idler carrier (including idler gear and crescent) to rotate automatically 180 deg through suction zone. This changes directional flow inside each pump without changing port positions. Each change of shaft rotation is accompanied by a corresponding shift in crescent position.



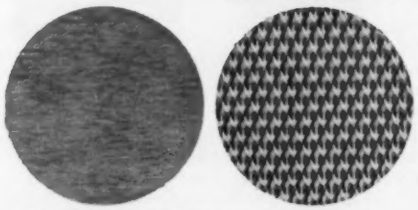
REVERSING CLUTCH SHAFT of recent engine and tool room lathe is used to drive reversible internal gear pump. It provides positive pressure lubrication of entire unit.



COMPRESSOR SHAFT ROTATION of hermetically sealed compressor cannot be determined as it is shipped from factory. Reversing pump overcomes lack of information on rotation.

SIMPLIFIED INSTALLATION is possible where reversible pumps provide lubrication of large gear reducers in either direction of rotation.

If you made aluminum crust for apple pie which would be best to use?



PLAIN OR PATTERNED? To help you decide, send for free sample kit of Fairmont embossed pattern sheets now putting new sales appeal into everything from awnings to truck bodies. Fairmont offers truly wide range of alloys, tempers, gauges, finishes. Write Dept. 29-L, Fairmont Aluminum Company, Fairmont, West Virginia.

THE RIGHT ANSWER TO ALUMINUM BUYING PROBLEMS depends upon right materials utilization.

For instance—many an item slated for plain sheet (because this *seems* to be most economical) can really be fabricated on a more practical level with one of Fairmont's embossed patterns. A lighter gauge embossed material provides dimensional stability, increases yield on a cost-per-pound basis, improves product eye-appeal.

MORAL: before final buying decisions are made, consult with a Fairmont field engineer. His mature and varied experience among aluminum fabricators makes him a whiz at application ideas that help you buy profitably. And he's backed by the aluminum source, according to a recent survey, that rates first for fulfilling promises and commitments.

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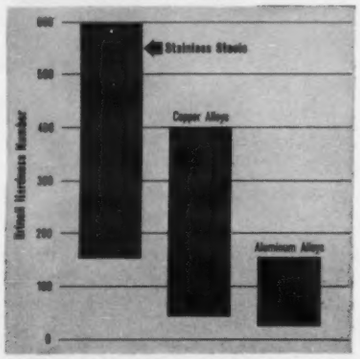
stainless steels give design engineers a wider application range

In your constant search for materials that serve a wide range of design applications, investigate the performance characteristics of Carpenter Stainless Steels. The following data highlight several important reasons why these versatile steels continually deliver bonus benefits to both design engineers and manufacturers.

Greater hardness range

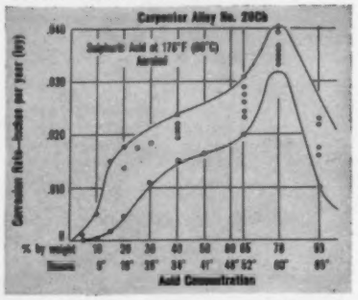


Only stainless steels can give you the combination of good corrosion resistance with sufficient range of hardness to meet any of your requirements. For example, fully annealed 18% Cr-8% Ni stainless steels such as Carpenter Stainless No. 4-A (Type 304) have a Brinell hardness of about 150, whereas heat treated Carpenter Stainless No. 440-C (Type 440C) can be as hard as 600 Brinell and both materials offer excellent resistance to a wide variety of corrodents. The range of hardnesses available with either copper-base or aluminum-base alloys is much smaller.

Superior machinability

The selection of Carpenter Stainless No. 5 (Type 416) for this level wind shaft for a fishing reel gave the manufacturer good machinability and eliminated expensive handwork on the shaft. It also provided excellent resistance to corrosion and unbeatable wearing qualities. A good example of a wise choice in metal selection.

Better corrosion resistance

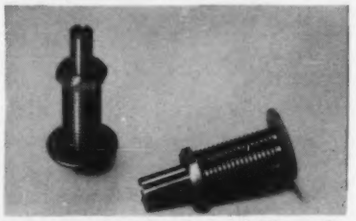


The wide range of stainless steels available offers the designer the exact degree of corrosion resistance necessary for almost any corrosive environment. For mild corrodents, inexpensive Carpenter No. 1 (Type 410) can be used; for extremely severe corrodents such as hot sulphuric acid solutions, Carpenter No. 20Cb should be specified. For other corrodents, one of the many other stainless steels will be the most economical material for you to use.

Carpenter No. 20Cb is a special alloy first produced by Carpenter in wrought form. Its excellent resistance to hot sulphuric acid is shown in the chart above. For information on its resistance to other corrodents, send for booklet, "Super Corrosion Control."

Easier quality control

Here's an application where Carpenter Stainless No. 8 (Type 303) provided an unexpected bonus! These bushing and shaft assemblies for a push-button unit in an explosion-proof switch were formerly made from a non-ferrous metal. After switching to Carpenter Stainless No. 8 (Type 303) to gain more uniform machinability and noncorrosive properties, this customer eliminated a costly inspection operation on the finished shafts. This was due to the consistently true size of the No. 8 bars (total tolerance: .0005" as supplied by the Carpenter mill).



Carpenter Stainless is available to the designer in many forms. Billets, bars and wire in a wide range of sizes . . . strip, tubing or pipe of varying thicknesses. Whatever form best suits your needs, you'll find one unique feature of Carpenter Stainless . . . its *consistent uniformity*. There's never the slightest change in composition in any one grade of Carpenter Stainless, no matter how big the order. Day after day, year after year, each melt of Carpenter Stainless is carefully controlled with the best equipment and human effort to bring you a reliable, consistent material, unsurpassed in uniformity. When the product you design goes into production, this consistent uniformity becomes extremely important. Specify Carpenter Stainless, and take a big step toward approval of your project.

Technical data available

Complete information on properties and characteristics of all grades of Carpenter Stainless is available in data sheet form. Send for yours today.

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Export Dept., Port Washington, N. Y.—"CARSTEELCO"
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Webb Wire Division, North Brunswick, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.

Circle 6 on Reader-Service Card for more information

SEEN AND HEARD

There is now a place called Engineers' Plaza in New York. It is the site of the recently dedicated United Engineering Center. The 20-story structure stands just opposite the United Nations.

The official dedication of this building is a proud moment for the engineering profession. The building houses 19 professional engineering societies and agencies, which represent 300,000 engineers. For the first time, all these groups are under one roof.

The $12,000,000 building is owned and operated by the United Engineering Trustees, Inc., composed of ASME, ASCE, AIMMPE, AIEE and AICE. Fifteen other engineering societies and agencies are part of the "family" in residence. The usefulness and influence of the UEC far transcend its function to these groups—it spreads to the entire engineering profession around the world.

The immediate effect of standing in Engineers' Plaza and looking up at the tall skyscraper is of strength and unity and growth. Those in the United Nations Plaza across the street cannot help but look at the Center with the same reaction. It is a great building, not just because it is tall and architecturally beautiful, but more because it represents the combined efforts of many individuals and industries, who, through their contributions and interest, made the Center possible. It is a symbol of free enterprise in which many professional groups participated to make it a success.

More than the engineering societies benefit from the unity exemplified by the UEC. The Engineering Societies Library is the most comprehensive in the world, with a present collection of 180,000 volumes, primarily on the level of the graduate and practicing engineer, 27,000 maps and 10,000 indexed bibliographies. More than 3400 periodicals and other serial publications from 50 countries in 20 foreign languages as well as English currently are received. The library maintains complete files on all technical publications and papers of its supporting societies and cooperates with the

Engineers' Plaza

V. W. Wigotsky, Eastern Editor

societies in the preparation of published indices.

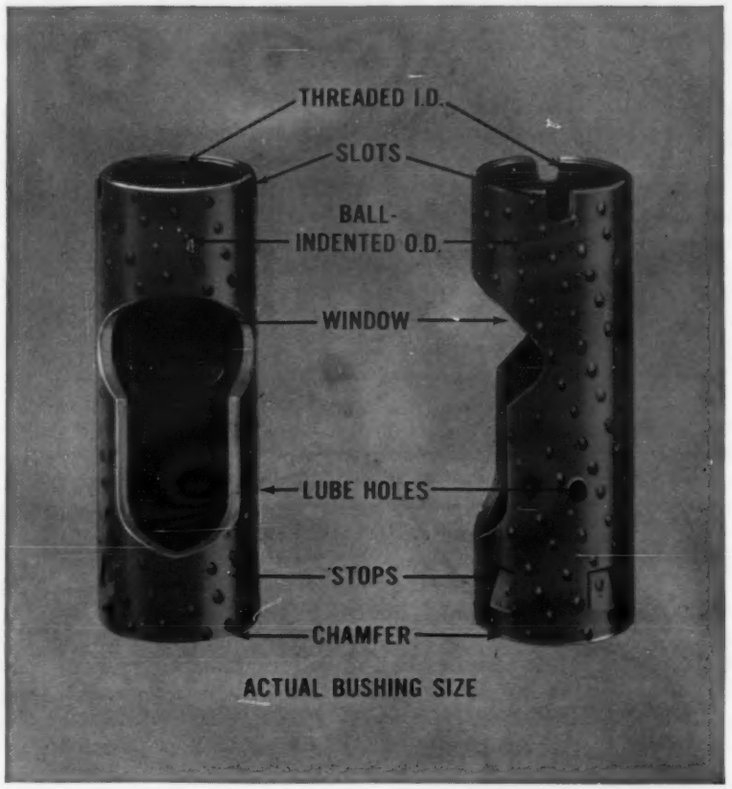
This tremendous mass of knowledge is available to any who desire it, not just to members of the societies. Requests for brief information which can be located readily are answered without charge. When extensive information is required, literature searches and bibliographies are made for a fee, with all inquiries kept confidential. Photoprints and microfilms of articles, translations and other services are also available at nominal cost. Only book loans are restricted to members; anyone can go to the library and use its facilities. This tremendous fountainhead of information is yours, whenever you want to make use of it.

Associated with the library is the Engineering Index, which is a world-wide technical indexing and abstracting service, available to all. Publications in all branches of engineering are reviewed. For each article the following information is printed on a 3-by-5 library card: a subject heading classification, title of article and name of author, name and date of publication and a brief summary of the article. Subscribers to any of the "field of interest" divisions, such as abrasives, ceramics, hydraulics and aircraft, receive all pertinent abstracts once a week, while subscribers to the complete service receive their abstracts daily—about 30,000 cards a year. All abstracts are compiled into one large bound volume, completely edited and cross-referenced. At the end of each year, applications of engineering methods and concepts to industry are covered by the index. No other abstract service of foreign technical literature has this extensive coverage.

Make use of this great service—it is there to help all engineers, industry, authors, educational and other interests.

This is just a small part of the story of the dedication of the imposing United Engineering Center. An engineer cannot help but "walk tall" when he sees this building and realizes the power and unity it represents. There is a solid front for America here at Engineers' Plaza and every engineer in the country is a part of it.

"EXOTIC" BUSHING MAKES NEW STEERING DESIGN COME TRUE



INSIDE-OUT BUSHING HELPS PUT NEW STEERING MECHANISM INTO PRODUCTION! To perfect a new steering mechanism, an automotive manufacturer required a linkage component. Designers tried making it of machined steel, then plastic . . . both materials failed. But the unusual bushing shown at left, with a number of features F-M engineers helped designers incorporate, solved the problem. It is bronze-on-steel, formed with the ball-indented bronze on the O.D. so the bushing can accommodate sliding motion within the mechanism. A large window makes insertion of a ball socket easy during assembly. Design of the bushing also includes: stops near one end to hold a disc . . . a threaded I.D. on the other with slots for a locking pin . . . holes that supply lubricant to the outer surface. For the F-M customer, all these built-in features helped accomplish this result—easy, efficient assembly and success with a new design.

CAN F-M BUSHINGS SOLVE problems on your board or on your assembly line? Or perhaps a sleeve bearing, thrust washer or spacer? F-M, who makes them all, can provide the answer. F-M engineers, with a wealth of knowledge from years of experience, are available to help design the needed component. This complete technical assistance is one reason why these F-M products are widely specified for use in automobiles, farm equipment, construction machinery and many other products.

Additional information about bushings is provided in a Design Guide, published by F-M. Helpful literature is also available on sleeve bearings, thrust washers and spacer tubes. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

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Automatic Transmission Has Fluid Coupling, Manual Override

R. F. Stengel, German Editor

A new four-speed automatic transmission uses only a fluid coupling and two planetary gear sets for torque conversion. Three sets of multidisc clutches and brake bands provide versatility and, permit driver to limit upshift to second or third gear for engine braking. Unit has only 3 inches more length, 30 lb more weight than conventional gearbox.

The crankshaft is connected through a flexible disc to a fluid coupling. A sharp-edged wall at the outer diameter causes abrupt changes between radial and axial flow. In consequence, coupling is claimed to have high torque capacity with low slip, but low capacity at stall. Unit is welded; operating oil recirculates through a heat exchanger. Since the coupling has no reaction member, diameter and power losses can be kept small.

Torque conversion is accomplished by two planetary gear sets with identical ring gears. Three multidisc clutches and three brake bands provide choice of three ratios for each gear set. First set, whose sun gear rotates with the turbine, has 1:2.52, 1:1 and 1:—1.52; second set, with the planetary gear carrier connected to the output shaft, offers selection of 1:2.73, 1:1.58 and 1:1. Overall forward gear ratios are in geometrical sequence with 1.58 ratio, followed by a 1:4.1 rear axle ratio.

Gear combinations are arranged such that both planetary gear sets operate only in first or reverse. For second and third, only one planetary set is employed, while fourth is in direct drive as usual. This minimizes power loss and noise in the most frequently used gears. Forward clutches carry at most the engine torque, while forward brake bands sustain no more than 1.5 times engine torque.

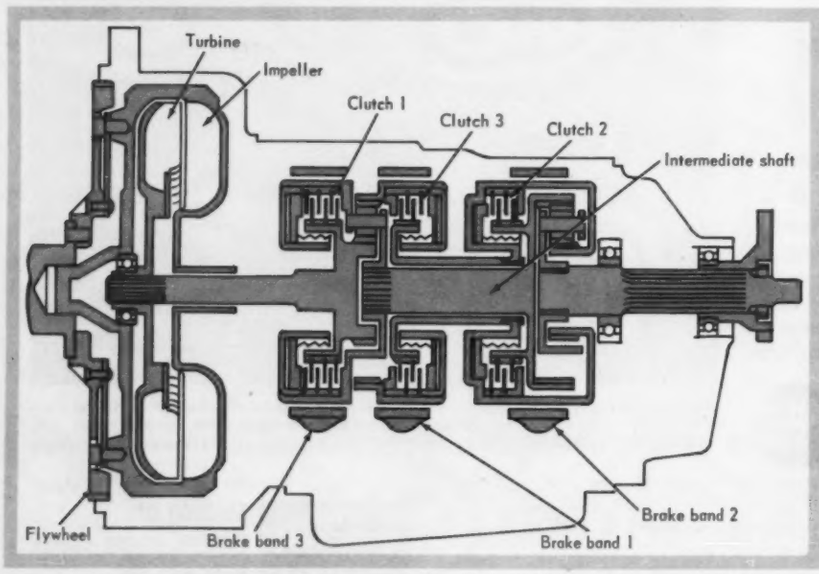
The two brake bands for forward operation are newly designed. To optimize open-throttle downshifts, the band should be applied at the instant when drum rotation changes. As time lag between start of shift and change of rotation varies from 0 sec (stall) to 0.8 sec (60 mph), band application now is controlled exactly.

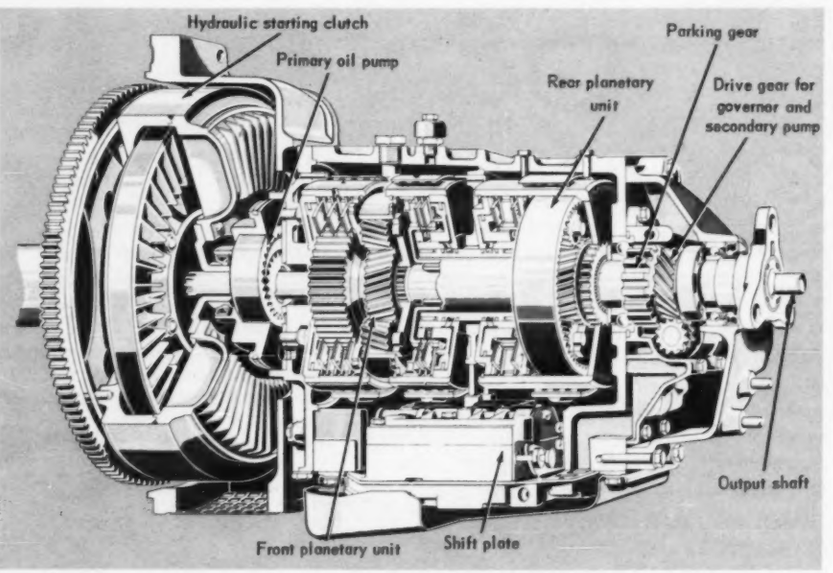
The rear face of the band piston is normally under pressure. An open-throttle downshift admits oil pressure to front face as well. Resulting force balance permits a spring to push piston into "waiting" position with low-force band contact. To speed piston motion, a valve in the piston rod connects both pressure spaces, permits necessary oil transfer in less than 0.1 sec. As soon as change of direction takes place, the spring overcomes the resistance of the brake band support, and the band is applied firmly. New two-stage application is expected to eliminate need for brake band adjustments.

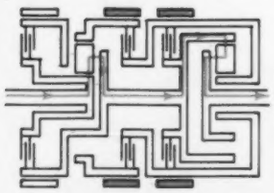
The governor divides the entire vehicle speed range into zones, leaving at any point a choice of two speeds only. Upshift points follow the full-power curve of the next higher gear, represented by a line of constant-intake manifold vacuum. Downshift points occur approximately at fixed car speed independent of throttle position.

Open throttle downshifts will not occur above that speed, to prevent breakaway under conditions of high speed and low surface adhesion, but a kickdown downshift is always possible for acceleration. The gearshift quadrant, in addition to the usual P, N and R positions, has forward positions 2, 3 and 4. Driver can manually override automatic upshift and limit transmission to second or third for mountain driving and engine braking.

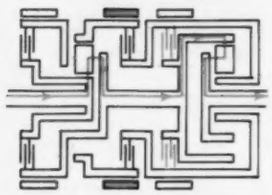
The new automatic transmission has been developed by Daimler-Benz AG., Stuttgart-Untertuerkheim, Germany, for use in the completely redesigned Mercedes 300 SE line.



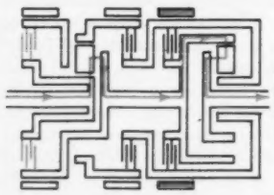




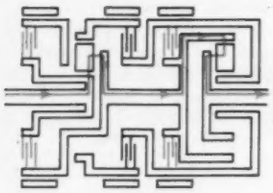
FIRST GEAR
Front planetary gear 1:2.52
Rear planetary gear 1:1.58
Overall ratio 1:3.98



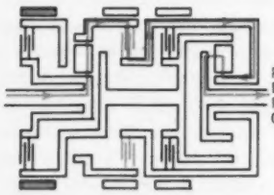
SECOND GEAR
Front planetary gear 1:2.52
Rear planetary gear 1:1
Overall ratio 1:2.52



THIRD GEAR
Front planetary gear 1:1
Rear planetary gear 1:1.58
Overall ratio 1:1.58



FOURTH GEAR
Front planetary gear 1:1
Rear planetary gear 1:1
Overall ratio 1:1



REVERSE GEAR
Front planetary gear 1:-1.52
Rear planetary gear 1:-2.73
Overall ratio 1:-4.15

SCHEMATIC SKETCH shows gear operation. Color identifies brake bands and clutches in engaged condition.

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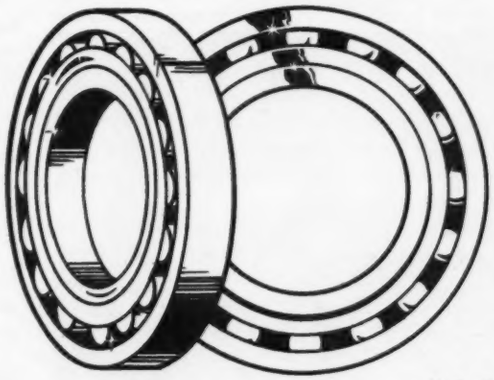

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Refrigerant-Cooled Motor Reduces Weight of Refrigeration Machine

E. J. Stefanides, Central States Editor

A liquid refrigerant-cooled electric motor is used to drive the compressor of a new hermetic centrifugal-type refrigeration machine for central-station air-conditioning systems. Especially designed for this application, the motor is an important factor in the achievement of the overall design objectives of minimum size and weight of the refrigeration machine package.

The motor, operating from a 480v, three-phase, 300-cps power supply, is a two-pole design which rotates at 18,000 rpm developing from 50 to 100 hp. It is cooled by the partial change of state of liquid refrigerant circulating within the windings and around the bearings.

This mode of cooling eliminates winding temperatures as a major design parameter and allows the motor to be designed for the optimum combination of operating characteristics. The resulting motor weighs less than 1/10 as much as the next smallest commercially available hermetic motor of the same horsepower rating.

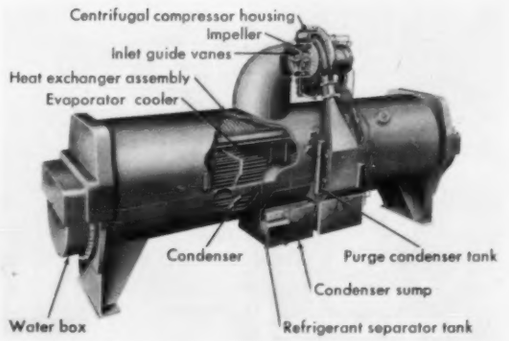
The design speed of the motor is also an important factor in reducing the size of the compressor. Because of this rotational speed, the compressor size is approximately 1/5 that of a similar compressor of the same capacity rotating at 3600 rpm. Further weight savings are achieved through the use of aluminum for the impeller and volute of the compressor.

Other features contributing to the reduced size and weight of the machine are combination of the cooler and condenser in a single shell and the use of simplified control and purge systems.

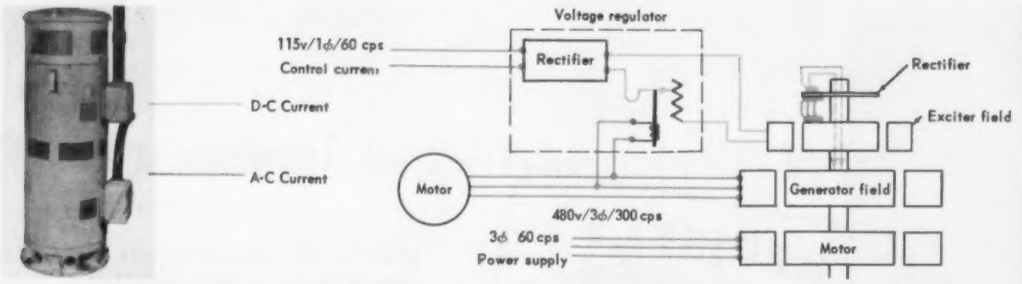
Combination of the cooler and condenser in the same shell is achieved through the use of a pair of divider plates which trap a gas space between them. This space acts as an insulating divider between the upper and lower halves of the shell and allows both components to be located in the same shell without loss of efficiency.

The purge system is a simplified design which operates without moving parts to remove air, moisture and noncondensables that accumulate in the condenser. Its compressorless design obviates the maintenance of the usual purge system.

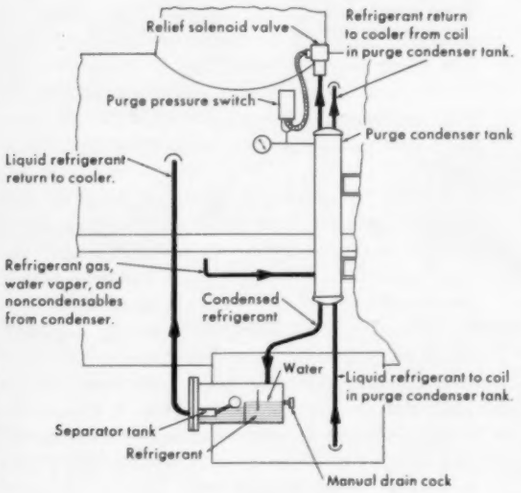
Only two primary controls are used to regulate the machine's cycle. These are a float valve in the condenser sump, which controls the flow of liquid refrigerant to the cooler, and the inlet guide vanes of the compressor. The vanes are controlled by the temperature of the water leaving the cooler and adjust the flow rate of vaporized refrigerant to the compressor and condenser.



PACKAGED REFRIGERATION MACHINE COMPONENTS are mounted on shell of combination cooler-condenser. In operation, liquid refrigerant in condenser sump is forced by pressure differential through float valve to horizontal header of cooler, then out through nozzles on bottom of vertical pipes along length of header. Emerging at high velocity below surface of liquid refrigerant, resulting streams increase agitation of refrigerant, improving heat transfer. Refrigerant in low-pressure environment of cooler boils off, extracting heat from remaining liquid refrigerant in which water chilling tubes are immersed. After vaporization, refrigerant is drawn off by centrifugal compressor and reconverted to liquid state by water-cooled condenser. Process is controlled by float valve in condenser sump and temperature-controlled inlet guide vanes on compressor. Refrigeration machine, complete with controls and insulation, is designed to pass through standard 36-inch door to simplify installation in existing buildings.



POWER UNIT provides 480v, three-phase, 300-cps power for compressor motor. Rotating elements, mounted on common shaft, are driven by three-phase, 60-cps motor. Rotation of rectifier with power-unit shaft eliminates need for brushes, slip rings and commutators. Input of 115v, 60-cps current is rectified and regulated to provide d-c to exciter field. Amplified three-phase output from exciter is rectified and converted to single-phase current for rotating field windings of 300-cps generator. Regulation of 300-cps output is achieved by coil across two leads of generator, which varies exciter field current to maintain constant voltage.

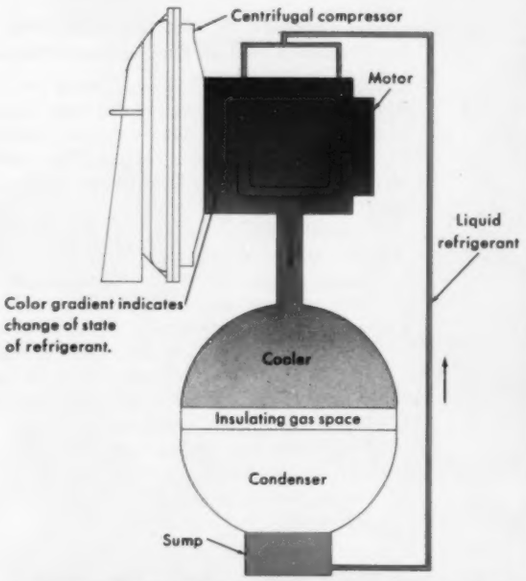

Relief solenoid valve
Refrigerant return to cooler from coil in purge condenser tank.
Purge pressure switch
Purge condenser tank
Liquid refrigerant return to cooler.
Refrigerant gas, water vapor, and noncondensables from condenser.
Condensed refrigerant
Water
Liquid refrigerant to coil in purge condenser tank.
Separator tank
Refrigerant
Manual drain cock

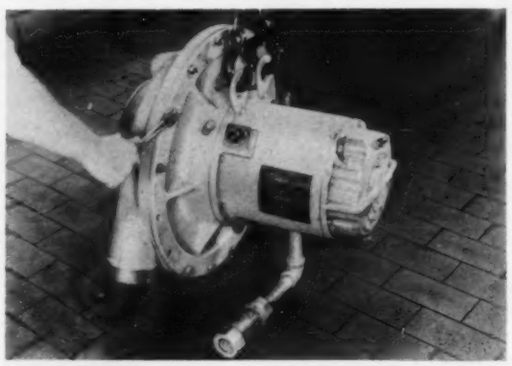
PURGE SYSTEM

INTEGRAL PURGE SYSTEM automatically evacuates noncondensable gases, air and water vapor from system. Pressure differential between condenser and purge tank causes flow of foul gases into purge tank. Water vapor and refrigerant vapor impinging against cooling coil condense and flow to separator tank where weir and baffle arrangement traps water and allows refrigerant to flow to cooler. Purge tank is equipped with pressure switch and solenoid valve to vent air and other noncondensables. Venting is automatic and occurs when pressure reaches predetermined setting.

Intended for commercial and light industrial applications, the packaged machines will be manufactured in ratings from 50 to 105 tons. The largest model of the line weighs only 6700 lb and requires only 31 sq ft of floor space. Similarly rated units of conventional design weigh up to 15,740 lb and have floor space requirements ranging from 87 to 183 percent greater.

These units are designed and manufactured by the Industrial Div. of American Standard, Detroit, Mich.





100-HP MOTOR AND MATCHING COMPRESSOR have total weight of approximately 350 lb. Motor is cooled by liquid refrigerant for maximum performance, minimum size and weight. Liquid refrigerant from condenser flows through motor to cooler, partially expanding in process. Motor is designed to operate at 18,000 rpm to provide optimum proportions for compressor.

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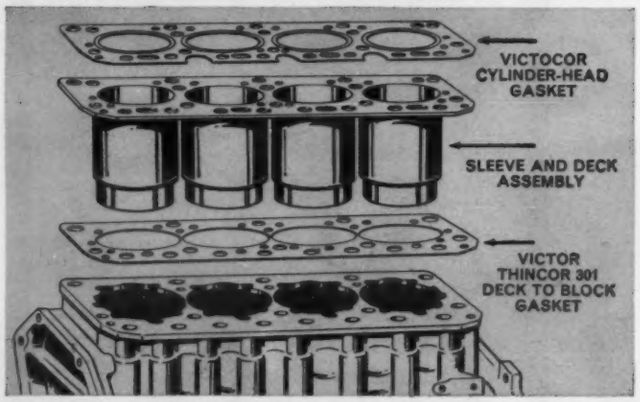
New THINCOR 301 Gasket Holds Vital Deck-to-Block Seal on Unique Deere Engine

Thousands of working John Deere tractor Models 1010 and 2010 certify this case history—a typical example of Victor gasket development for exacting power sealing. The power unit, Deere's distinctly new sleeve and deck diesel, is also built for gasoline or LP fuels.

The most critical seal—cylinder deck and block assembly—is held tight by a *THINCOR 301* gasket under these conditions: extreme dynamic loading—high temperatures—large exposure to coolant—small contact areas. *THINCOR 301* is *Victopac®*, mechanically bonded to a perforated thin steel layer to resist gasket extrusion. The steel side is precoated with high-temperature aluminum sealant.

The cylinder-head gasket helping these engines deliver full-rated power is *Victocor®*. This highly compressible and resilient thin steel core gasket is widely specified for heavy duty.



EXPLODED, PARTIAL ENGINE VIEW showing sequence of block to cylinder-head gasket assembly. The critical cylinder-deck to block seal is made with Victor THINCOR 301, the thinnest, metal-supported, tight-sealing gasket available today for preventing distortion of mating parts.

Victor Oil Seals Specified

Front and rear crankshaft seals . . . wheel bearing seals . . . transmission, external and internal, and final drive assembly oil seals are among many Victor designs helping the performance of Deere 1010 and 2010 tractors.

Let's Get Our Engineers Together

With no obligation either way, Victor engineers are available for counsel on your sealing specifications. Your inquiry invited; also your request for latest engineering catalogs on Gaskets and Oil Seals. Victor Mfg. & Gasket Co., P.O. Box 1333, Chicago 90, Illinois.—Canadian Plant: St. Thomas, Ontario.

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GASKETS • PACKINGS • OIL SEALS • MECHANICAL SEALS

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Transparent Font Plate

R. F. Stengel, German Editor

Addition of a transparent font plate and special sensitive paper or transparent foil to an enlarger permits typesetting under optical control. Particular advantages are infinitely variable type size and versatility in setting, mirror-image or negative printing.

Light from a 200w projection lamp is focused by a standard enlarger optical system to pass through a 75- by 5-cm, 2-mm-thick transparent plate which contains a negative film image of an entire type face arranged in two rows. The type plate moves horizontally in a light-sealed slit in the enlarger head to position the desired letter in the light beam. A lever shifts the type plate between upper-case and lower-case letter rows.

Optical positioning of letters is done in dim daylight, as a red filter keeps the projector lamp from exposing blue-sensitive orthochromatic paper. A pushbutton timer triggers a magnet which retracts the red filter for an exposure time variable from 1 to 6 sec. A few seconds after exposure the letter appears on the special paper or transparent foil in saturated black and serves as optical reference for the next letter. A horizontal bracket line can be projected and printed under each letter. Coincidence of adjoining end marks of bracket lines assures even spacing. Printed type becomes permanent in a fixing bath.

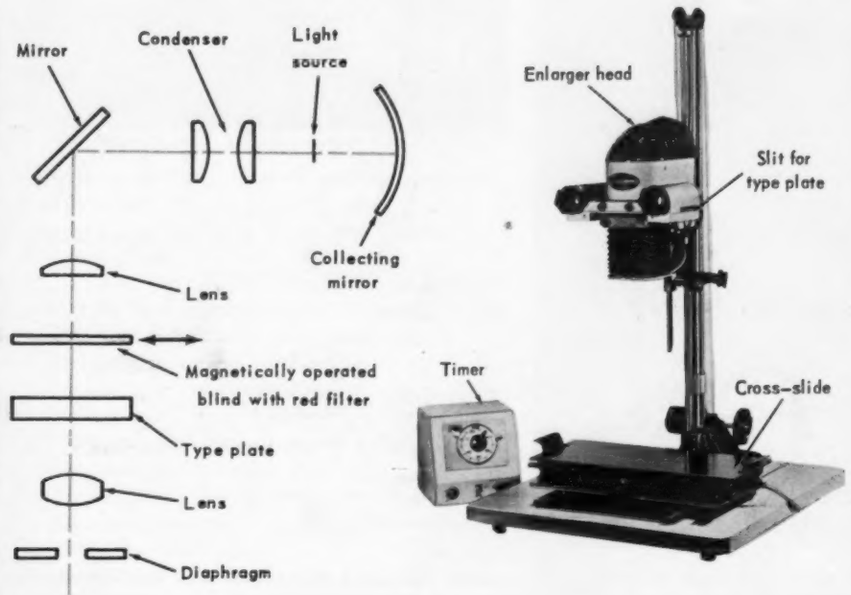
The paper or foil rests on a two-way, 22- by 24-inch cross-slide which also turns through 360 deg. Base plate motion makes it possible to set letters slanted, curved or superimposed, with screen-shadow effect of the second imprint.

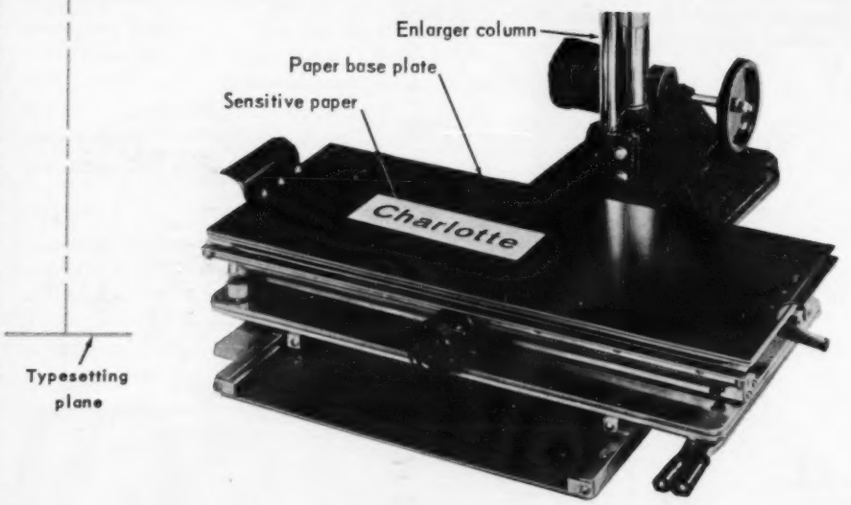
The enlarger uses a Schneider Componar 1:4.5, f/80-mm lens. It can be focused over a wide range. A single type-face plate is therefore sufficient to set type of continuously variable height from 3/32 to 4 inches.

For typesetting on conventional film, the sensitive paper is used as optical control only. After each letter has been positioned, the paper support plate is removed from the cross-slide. The commercial film, resting on a second plate, is raised by springs against end stops which assure equal focus. Darkroom lighting is necessary for film processing.

The "Starlettograph" light-setting device, the sensitive paper and transparent foil and a sensitizing bath are developments of Film-Klischee GmbH, Munich, Germany.

Converts Enlarger into Optical Typesetter





Design News

SAMPLE COMPOSITION was hand-set in two minutes

Model No. Ratings
MODEL 6E—permanent split capacitor, 6 pole, 1050 rpm. Quieter and cooler running than other current design motors, this L-N motor can put an end to problems of high current drain with low current requirements. Excellent power factor and efficiency in room air conditioning use.
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486E 1/4
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Shaded pole motors (1/150 to 1/4 hp) and PSC motors (1/15 to 1/3 hp)
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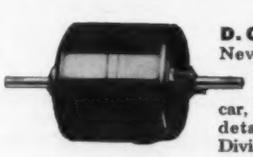
Leece-Neville offers you a complete line of shaded pole and permanent split capacitor A.C. motors and fractional D.C. motors —with horsepower ratings from 1/150 to 1/3 hp. All L-N motors are capable of meeting U.L. or C.S.A. application tests. Select a basic unit modified to your specification, or a special motor (custom engineered) to meet your requirements. Modern facilities assure top quality and delivery to your schedules. For complete information, write The Leece-Neville Company, Department DN-12, Georgia Division, Gainesville, Georgia.



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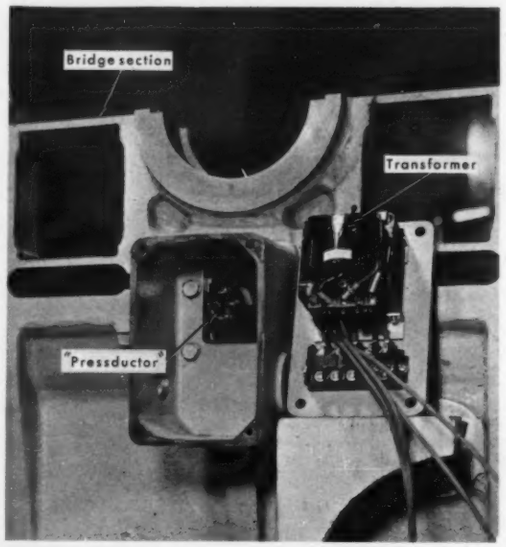
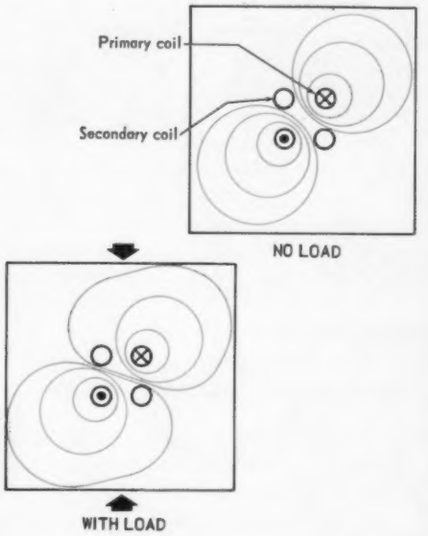
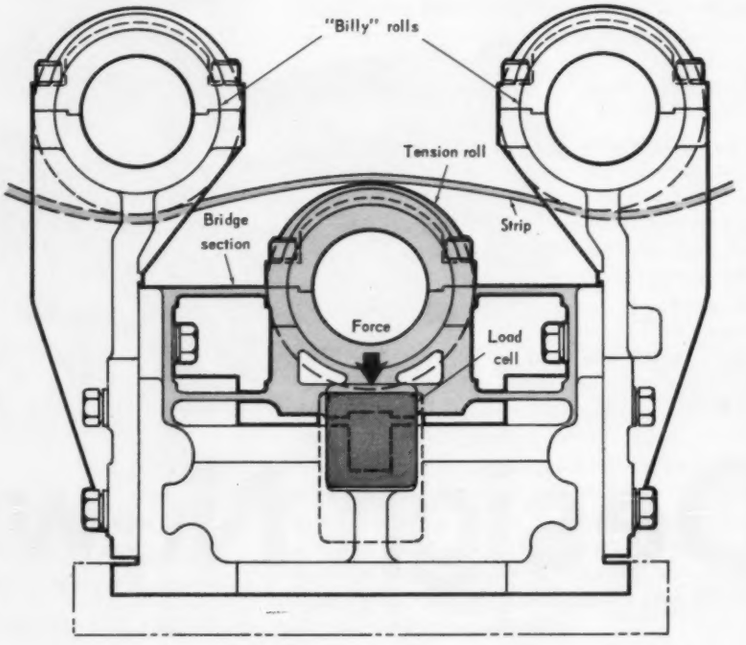
Tensiometer Uses Bridge Mounting, Low-Deflection Load Cell

Lars G. Soderholm, Midwest Editor

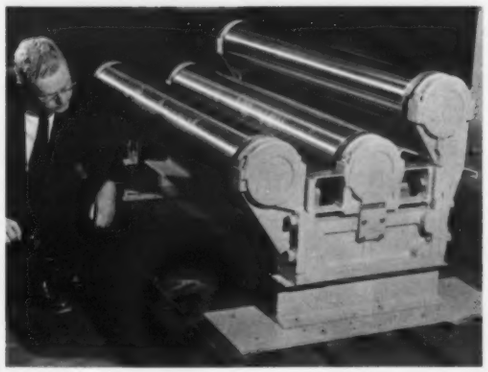




"PRESSDUCTOR" LOAD CELLS, developed by ASEA in Sweden, are composed of number of square stampings with four holes at diagonal corners. Two coils are wound and cross each other at right angles. In "no-load" stage, lines of flux caused by current in primary winding do not affect secondary wiring. As load is applied to load cell, flux is deviated to transverse direction by amount proportional to load. This causes current flow in secondary winding that can be measured.



TENSION MEASUREMENTS of steel strip are made through tension roll deflection as strip passes between one or two "billy" rolls and tension roll. Bridge linkage uses four cast and machined ribs to transmit single directional force to load cell. Small deflection of load cell (0.002 inch maximum) makes compensation for load imposed by bridge linkage relatively simple.



A four-bar bridge linkage is used on a tensiometer to transmit force from the tension roll to a low-deflection ASEA "Pressductor" load cell (DESIGN NEWS, Dec. 19, 1960, page 30). The load-cell reading completes a force triangle in which the hypotenuse is an indication of tension in the strip fed through the tensiometer.

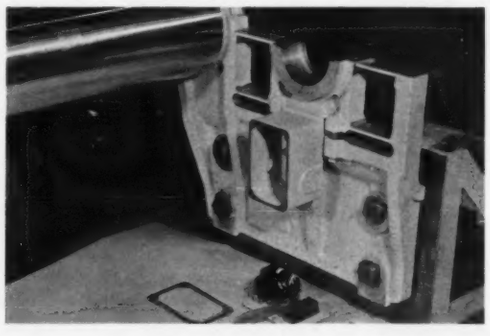
Direct measurement of strip tension during operation of a cold-rolling mill has been difficult because of the need to translate tension into movement. Large movements of the tension roll change the force triangle and inject serious errors in tension measurements.

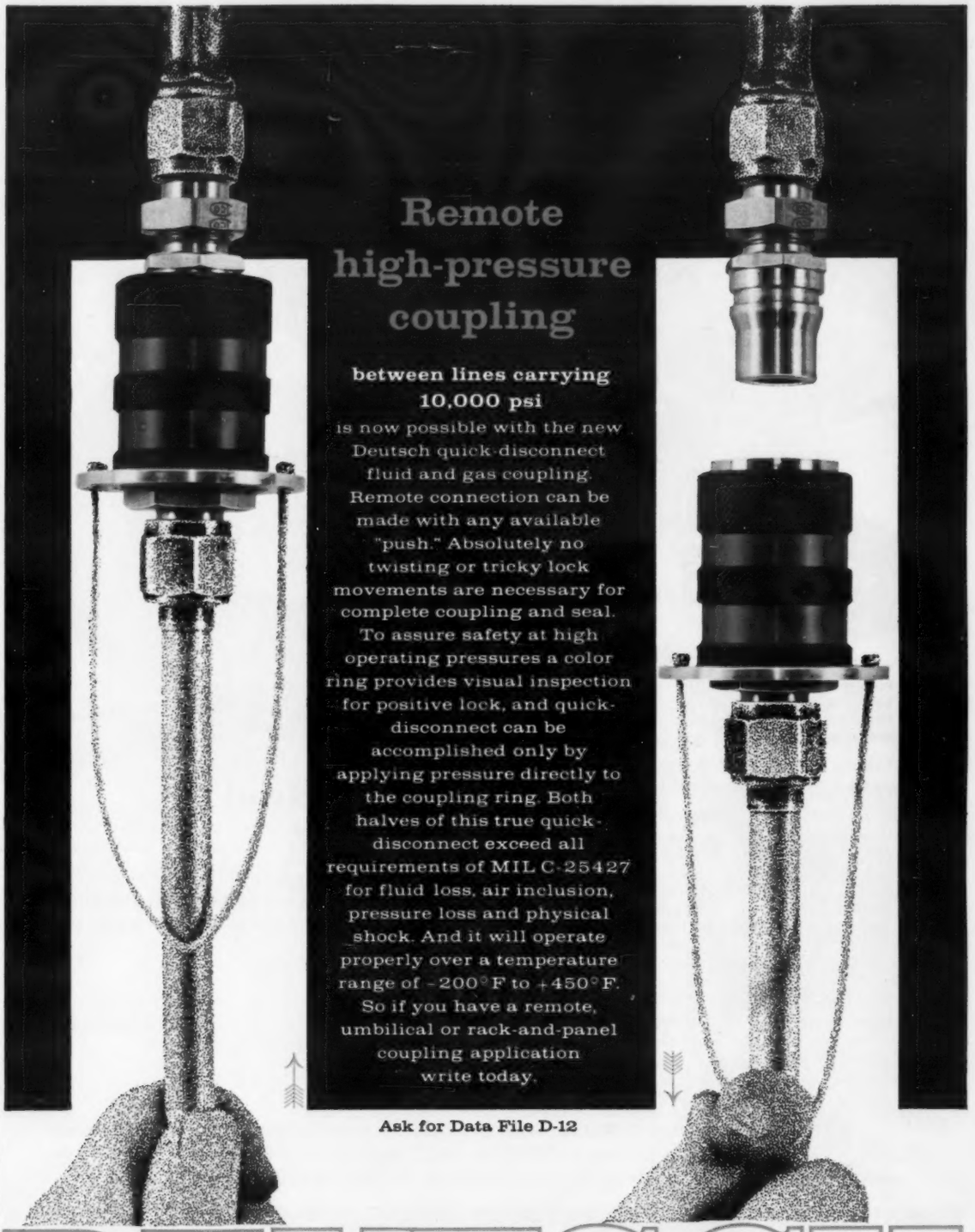
This deflection problem was solved by using an ASEA low-deflection "Pressductor" load cell that has a maximum movement of only 0.002 inch. The "Pressductor" load cell has low power requirements but is still capable of operating its indicating instruments without amplification.

Various configurations using one or two "billy" rolls with the tension roll are available. Hollow, chrome-plated, dynamically balanced rolls are used for low inertia during acceleration and deceleration of the mill. Electrical components have been placed in watertight enclosures.

Tension measurements up to 100,000 psi are possible in reducing mills. These measurements can be taken at strip speeds up to 8000 fmp.

The new tensiometer was developed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis.

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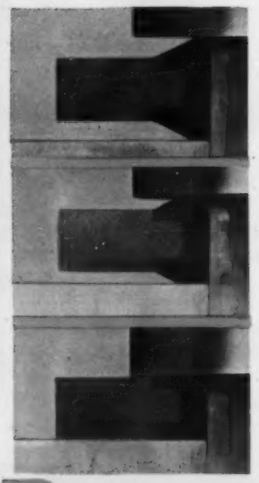

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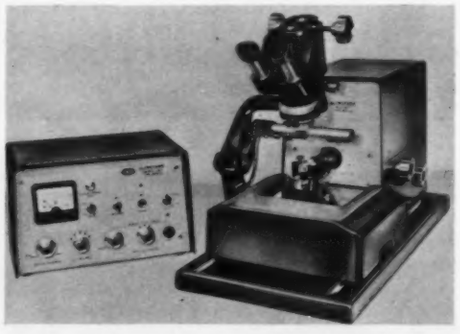
Feed by Thermal

Thermal expansion of a specimen-holding arm provides automatic feed in a cutter for microscopic samples. Cutting force is the weight of the arm. Absence of motors and mechanical linkages for feeding and cutting eliminates vibrations. Slices down to 100 angstroms thick are achieved.

Specimen suspension is of the "goniometer type". Rotatable about three oblique axes intersecting close to the knife edge, the arrangement facilitates setup and permits universal movement of the specimen about the cutting point. The knife edge itself is rotatable about two axes intersecting at the same point. The optical inspection system also tilts about this point.

The device is suitable for work in ultrastructure research with electron microscopes. It covers a wide range of slice thicknesses and permits serial sectioning for three-dimensional reconstruction of elements. It can cut hard and soft materials and is simple to operate.

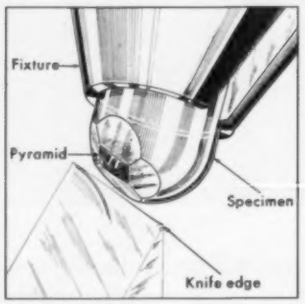
Designated Ultrotome, it was developed by LKB-Produkter AB, Stockholm, Sweden.



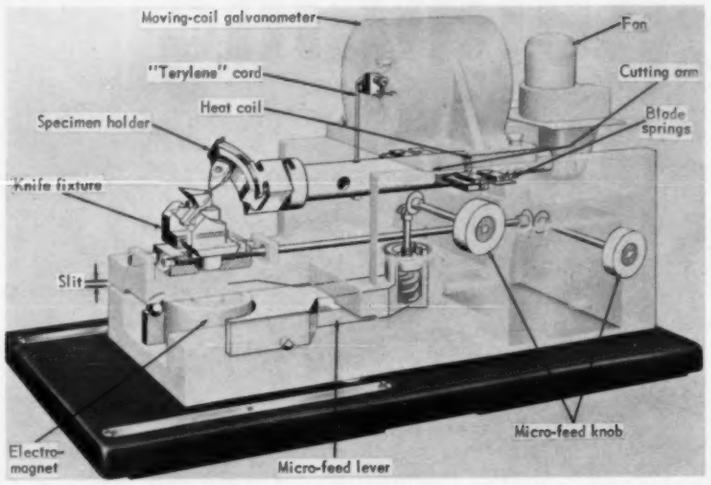
ELECTRONIC CONTROLS are located in separate unit. Constant cutting frequency of 20 strokes per minute is used. Cutting speed ranges from 2-50 mm per sec. Automatic feed provides slice thicknesses of 100-1000 angstroms. Greater thicknesses can be obtained at pushbutton rate or by the manual microfeed system.

Expansion Permits Cutting of Ultrathin Slices

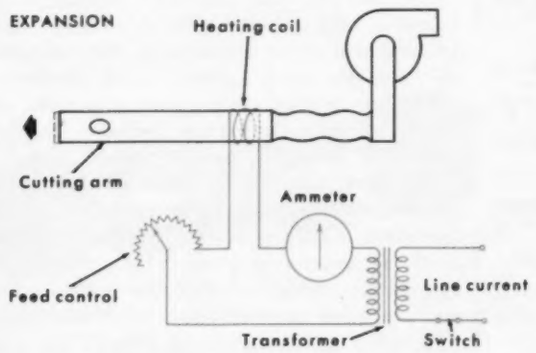
Volrath Holmboe, Correspondent in Sweden

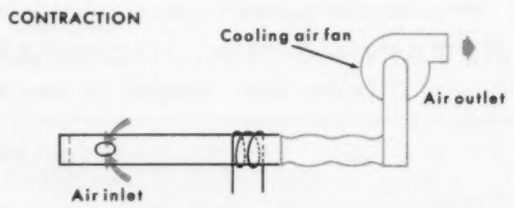


KNIFE consists of stress-free glass. For cutting metals, diamond edge may be used. Angle of cutting edge ranges from 40 to 47 deg. Specimen is trimmed to small rectangular pyramid as shown in figure.

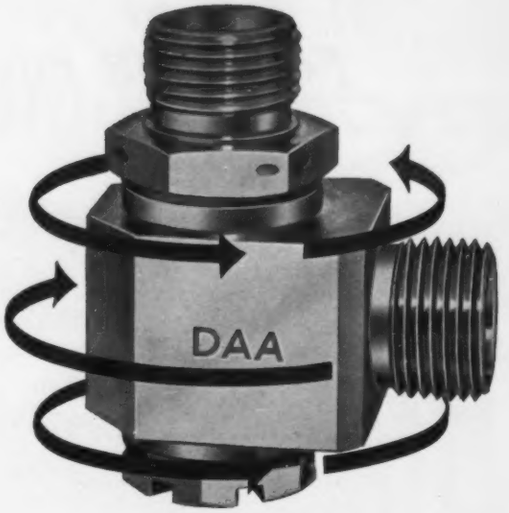


CUTTING ARM is attached to main unit by two horizontal blade springs. This makes arrangement free from play and insures cutting in desired vertical plane. Falling speed is controlled by moving-coil galvanometer attached to arm by "Terylene" cord. Movement of galvanometer follows preset program governed by transistor circuit in accordance with cutting speed setting on control panel. Electromagnet pulls flexible table top down during return stroke to keep specimen clear of knife edge. Flexible table top also is used for manual micro-feed. Lifting of table top provides feed by tilting cutting edge toward specimen. Lifting is obtained by means of lever pivoted on two balls. Also, manual micro-feed system for rapid setting of knife is included.





THERMAL EXPANSION is obtained by short heat coil wound around rear end of cutting arm. Expansion rate is changed by variable resistance operated by automatic feed-control knob. Slice thickness is determined by heating current because of constant cutting frequency. Ammeter calibrated in angstroms reads slice thickness directly. Heat from coil provides linear expansion for about 20 minutes. Contraction through cooling is obtained by fan, which sucks air through cutting arm to outlet at rear.



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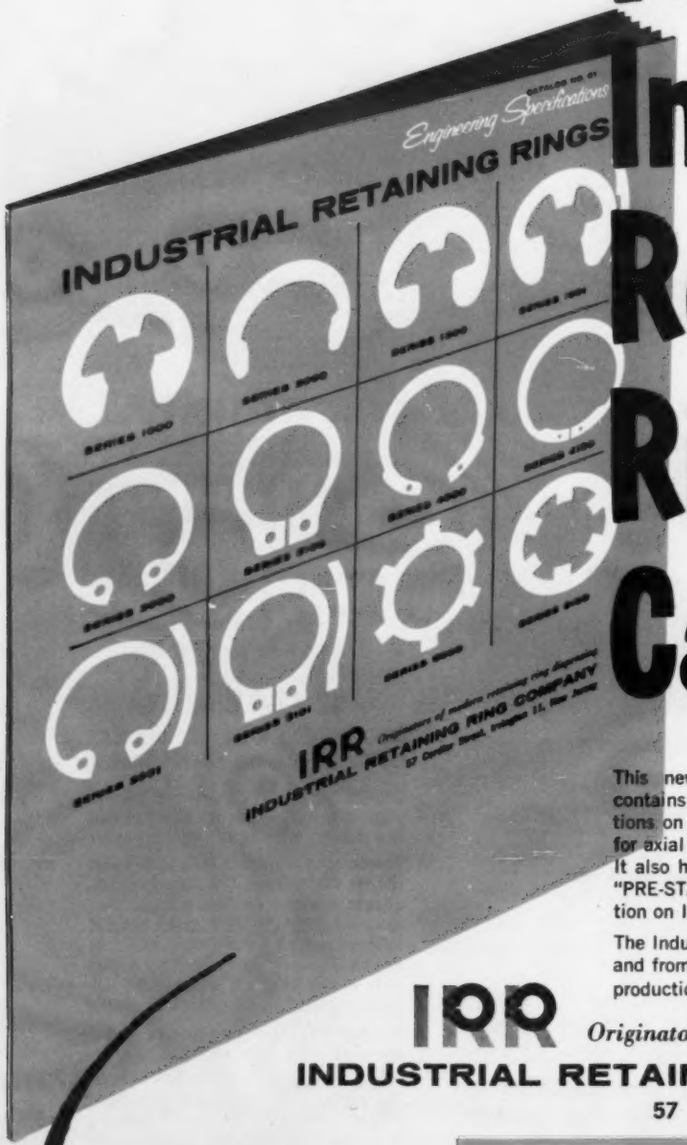
For YOUR File . . . **New! Industrial Retaining Ring Catalog**



This new Industrial Retaining Ring Catalog, No. 61, contains complete information and engineering specifications on IRR Internal and External Retaining Rings—both for axial and radial assembly—from sizes .040" to 4.125". It also has information of the exclusive, time-saving, IRR "PRE-STACKED" Axial Assembly Rings as well as information on IRR Pliers and Accessories.

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Piston Pump Bearings

Lars G. Soderholm, Midwest Editor

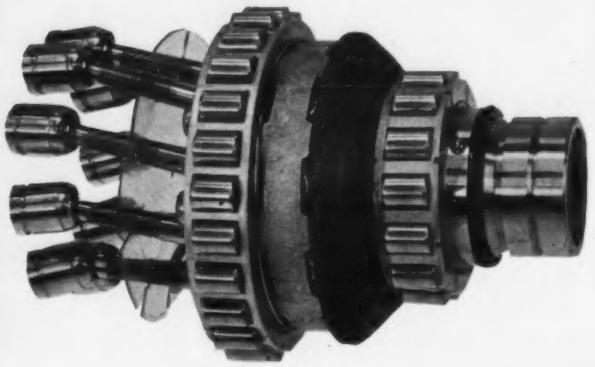
A line of angle-type, fixed-displacement hydraulic pumps and motors achieves high horsepower per pound ratios at average piston velocities (about 15 fps). High efficiencies are obtained in part by the use of self-adjusting bearings that shift to accommodate off-center loads. Also contributing to high efficiencies are a special short universal joint, an internal flow pattern to remove frictional heat and precision manufacturing methods for pump components.

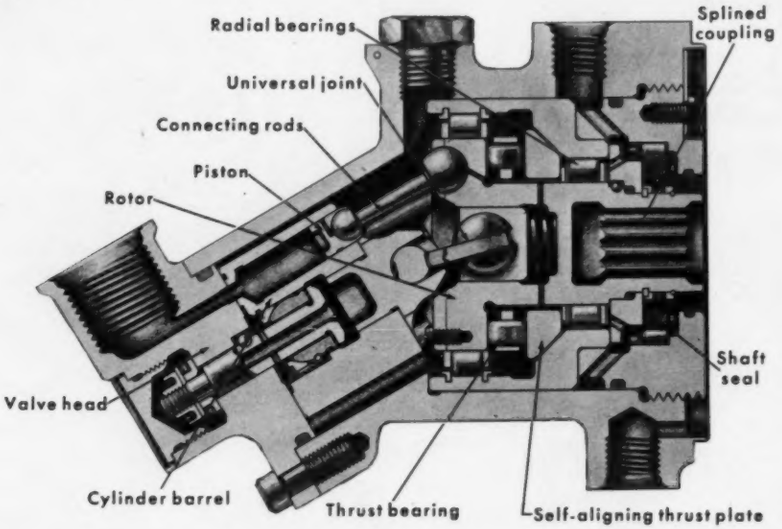
Reaction forces from the fluid bearing on the pistons are transmitted by the connecting rods to the rotor. These forces produce both radial and thrust loads on the rotor which are resisted by two radial and one thrust-type bearing. A self-aligning thrust plate is used to back up the thrust bearing, while the radial bearing is designed to tolerate some axial movement. These bearings will adjust themselves so they will sense only the true loads applied by the connecting rods. They further are designed to prevent any load increasing interaction between bearings caused by changing loads or speeds.

The new units follow the basic long-stroke angle-type design with certain exceptions and refinements. A fatigue-resistant, nonferrous splined coupling connects the pump to the power supply. A compact, constant-velocity universal joint connects the rotor and the nine-bore cylinder barrel.

Internal leakage is forced through the bearings and out through a case drain port. This flow of fluid removes the frictional heat generated in the bearings and provides a continual flow of oil to remove any contaminated particles

Adjust to Give Proper Load Distribution





PISTON PUMP rotor is driven through splined coupling. Compact universal joint transmits rotation to cylinder barrel. Spherical connecting rods cause pistons to reciprocate in cylinder barrel bore, pumping fluid received and discharged through valve plate section of valve head.

UNIVERSAL JOINT consists of two grooved spherical heads and connecting link. Grooves in heads receive splines in member they connect. Joint is fabricated from heat-treated, surface-hardened alloy steel. Universal joint is designed as smallest size capable of transmitting power to accelerate and decelerate cylinder barrel and overcome frictional forces acting on valve surface.

which may become silt in the bearing section.

For high-temperature operation and contaminant resistance, the cylinder barrel and pistons are hardened alloy steel. The port plate is nonferrous to provide a low-friction, nongalling surface. The same general design is used for both hydraulic motors and pumps in displacements from 0.04 to 4.00 cu in per revolution and 4.86 to 124.0 hp at 3000 psi. They are made by the Stewart-Warner Corp., South Wind Div., Minneapolis, Minn.

New Rotac MIDGET Rotary Torque Actuator

Use it to lift, lower, turn, rotate, index, clamp, transfer, toggle, press, load, unload, oscillate or turnover.

Mount it vertically, horizontally, or at any angle.

Rotate or oscillate it in any arc to 270° with either keyed shaft or body rotating.

Power it with air, oil or fire-resistant fluids.

Control it with simple valving for starting, stopping, slowing-down or speeding-up.

Apply it wherever you need instant torque and controlled rotary power. Current uses include: instrument and computer designs, small parts handling, remote control of valves and switches, and other light applications.

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Examine its design by sending today for free design data book—gives engineering data, power ratings, mounting details. Or call your Rotac Representative for details.

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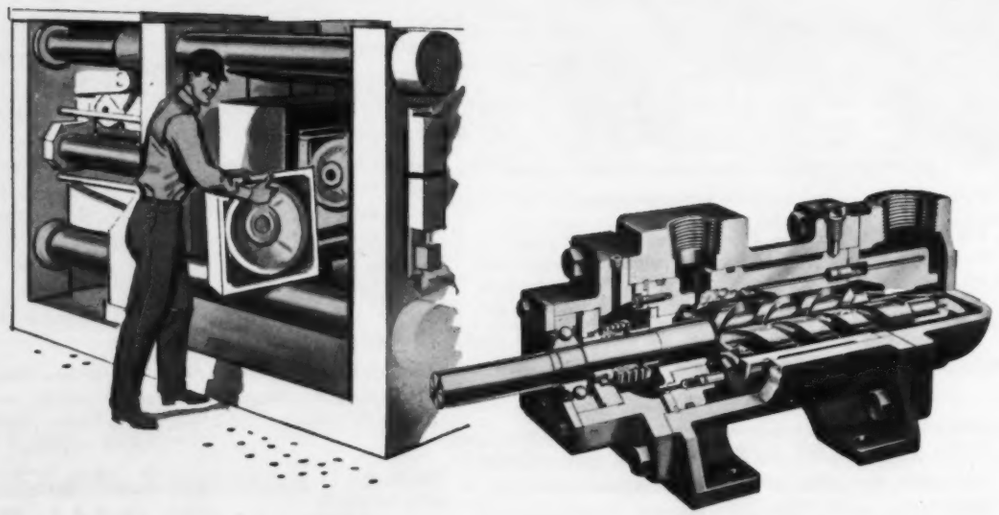
IMO pumps have been applied widely on phosphate-ester and water-glycol fire-resistant fluids. On water glycols, where rotary pumps in general have not performed too well, standard IMO pumps have been applied with excellent results and high resistance to leakage. To apply IMO pumps on phosphate-ester fluids, it is necessary only to change seal and "O"-ring materials.

Versatile IMO pumps deliver maximum performance in many varied power-hydraulic applications. Besides dependability with fire-resistant fluids, IMO pumps offer non-pulsating flow, quiet operation, high speed, wide capacity range, and reliability. Compact design saves expensive floor space. Installed cost is lower than for other types of pumps. IMO pumps cut maintenance, too . . . only three moving parts!

For application and performance data, selection information, dimension drawings and tables, write for Bulletin IM-3200.

De Laval Steam Turbine Company, Trenton 2, New Jersey.



IM-DL-103

DE LAVAL · 60 YEARS OF CREATIVITY AND QUALITY

CENTRIFUGAL PUMPS AND COMPRESSORS • TURBINES • IMO® ROTARY PUMPS AND HYDRAULIC MOTORS
MARINE PROPULSION AND AUXILIARY EQUIPMENT • HELICAL AND EPICYCLIC GEARS • TURBOCHARGERS

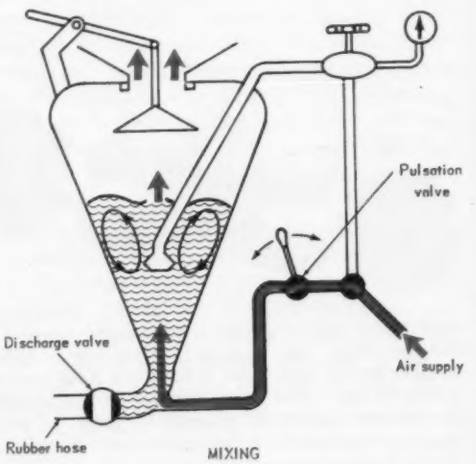
Compressed Air Mixes And Discharges Explosive

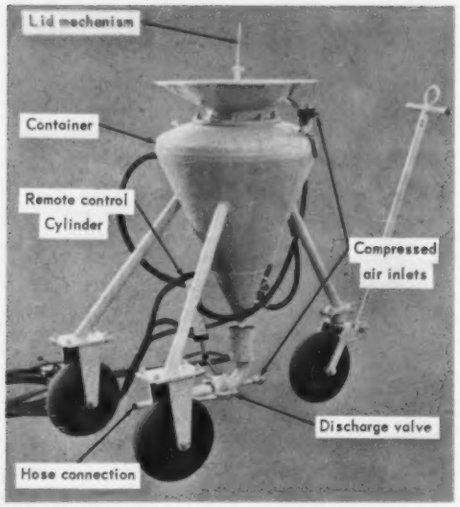
Volrath Holmboe, Correspondent in Sweden

Pulsating compressed air entering at the bottom of a conical container efficiently mixes ammonium nitrate and diesel oil to so-called "AN-Oil" explosive. The mixing process uses no moving parts.

Discharging, the container is just under pressure and a valve is opened. The mixture then is pressed out and fed through a suitable rubber hose to the blast hole. The hose gradually is pulled out of the hole as it fills, at about 10 meters per minute.

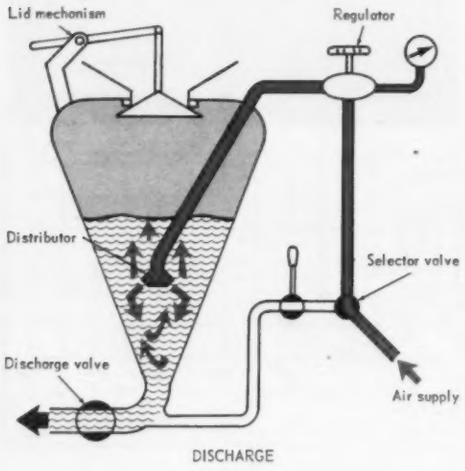
Site mixing eliminates the inconvenience of transport and storage of explosives. The combined mixing and loading device, covered by several patents, is designated "BLU-ROX". It is marketed by DUROX Export Co. AB, Gothenburg, Sweden, and was developed in conjunction with the two Swedish firms, AB Agentor and Boliden Mining Co.





NATURE OF "AN-OIL" MIXTURE, together with loading system, permits loading in all directions. Pneumatic cylinder provides remote control of discharge valve by man at blast hole to permit one-man operation.

PULSATING AIR from hand-operated valve enters through inverted apex of conical container for mixing. Arrangement provides periodical lifting of mixture at center of container, with subsequent falling along conical walls. Open lid permits escape of pulsating air. Mixing takes about 3 minutes. Discharge results from applying pressure through central distributor and opening discharge valve. Small outlets along circumference of distributor are inclined downward about 45 deg. Direction of air jets from these outlets, together with carefully ground surface and steep slope of conical wall, provides uniform lowering of mixture across container without sticking. Air pressure in container keeps lid closed against rubber ring. Regulator maintains constant pressure during discharge. Coaxial arrangement of pulsating air feed and discharge valve permits cleaning of rubber hose with compressed air jet.



NOW— another FIRST by the Originator of Eddy-Current Equipment

NEW DYNAMATIC® Model 905 Ajusto-Spede® Drive

Red tint indicates output member

Extends Capacity Range to 15 HP in the Popular Quill-Type Design

The addition of the new model ACM-905 to the famous ACM-903 and ACM-904 lines of Dynamatic Ajusto-Spede Drives makes the desirable features of Dynamatic Quill-Type design available for many new applications.

Dynamatic Ajusto-Spede Drives provide controlled adjustable speed from an AC power source. Standard control features include on-off clutch control, infinite speed adjustment, constant speed regulation, and jogging. Any of a variety of special features may be easily and economically added to the standard control.

All Quill-Type models are available with either eddy-current, Dyna-torQ, or fail-safe brakes.

An Ajusto-Spede Drive, a control unit (either electron tube or transistorized magnetic amplifier), and a push-button station comprise a compact, easily installed, low-cost drive package.

Check these Ajusto-Spede® Advantages

- ★ Infinitely adjustable speed from AC power
- ★ Simplified construction
- ★ Compact design
- ★ Wide speed range
- ★ Remote control
- ★ Stationary field coils
- ★ Excellent performance characteristics

Send for Illustrated Descriptive Literature

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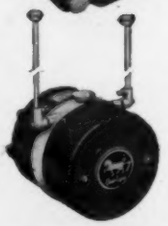
HIGH TORQUE at SLOW SPEED

complete your HYDRAULIC CIRCUITS with Char-Lynn COMPONENTS

HOLDKONTROL VALVE V-960

HORSEPOWER PUMP 400

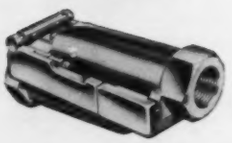


HI-LO POWER PAC PUMP E-600

STROKONTROL CYLINDER C-133

HORSEPOWER CYLINDER C-102

HYDRAULIC FLUID FILTER F-240

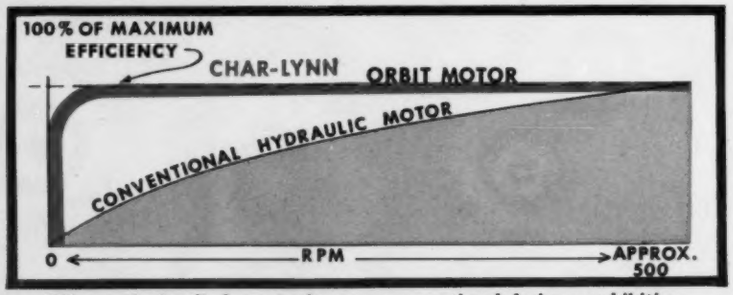


HOSE COUPLER H-730

New Char-Lynn Hydraulic ORBIT MOTORS® deliver Full Torque regardless of speed range

It's Here—A NEW concept in fluid power mechanics has brought about the development of a totally new fluid motor—A *High Torque—Low Speed* motor.

These motors open up complete new areas for design, never before possible. They offer a practical and economical hydraulic solution to the age-old problem of providing High Torque at Low Speeds for constant and variable speed drives—hydrostatic transmissions and remote controls *without* bulky, costly mechanical drives and gear reducers.



Whereas hydraulic losses make some conventional designs prohibitive at the lower speeds, Char-Lynn ORBIT MOTORS maintain high efficiency over the complete operational range.

- Speeds from 0—800 RPM
- Torques to 3300 inch lbs.
- Starting torque substantially equal to running torque
- Fully reversible — instantaneous starting—stopping
- Only 3 moving parts
- 4 types of mountings available
- 3 port sizes—7 power element selections
- Compact—lightweight
- Eliminates costly and complicated power transmissions
- High volumetric and overall efficiency

For complete details write Dept. HM Char-Lynn Company • 2843-26th Avenue South, Minneapolis, Minnesota

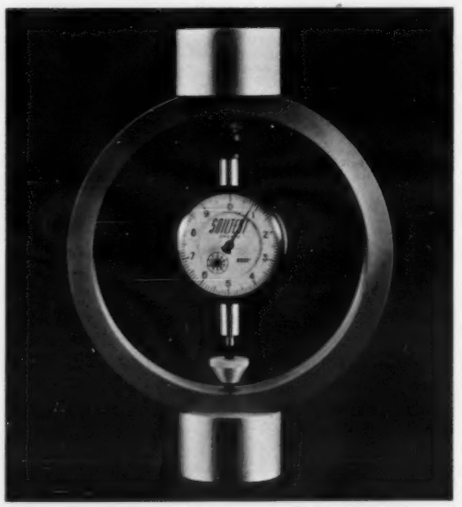
Char-Lynn HYDRAULIC HORSEPOWER PRODUCTS

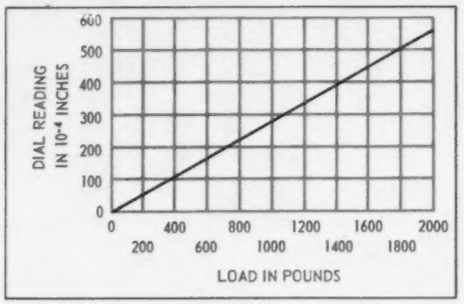
Proving Rings Provide Low-Cost Load-Indicating System

Single and double proving rings are used to provide accurate, low-cost load indication. Single rings cover a load range up to 20,000 lb while double rings combine a highly sensitive lower range with a stable high range.

Proving rings are circular rings machined from high-grade tool steel and are especially heat treated for maximum stability and sensitivity. Single rings are approximately 6 inches in dia by 1 inch wide. The thickness varies with the range.

Each proving ring is mounted in a pair of end blocks. Between the end blocks is a holder for a dial indicator which gives a minimum reading of 0.0001 inch and is accurate within one division on a repeat reading. The rings





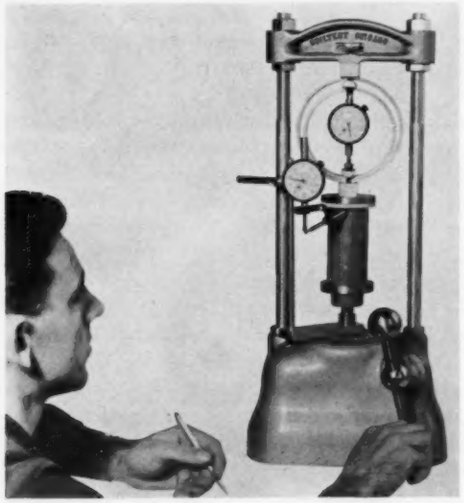
Lars G. Soderholm, Midwest Editor

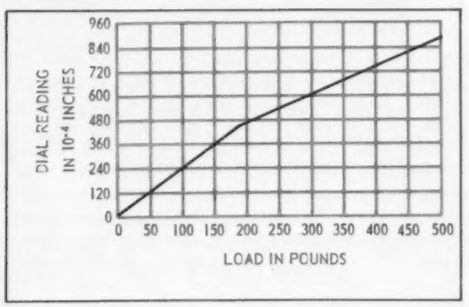
are calibrated at the factory and provided with a calibration chart.

The double proving ring is made up of two rings, one mounted within the other. Under load, the outer ring flexes first and measures the lower load ranges with great sensitivity. When the outer ring strikes the end block of the inner ring, both rings flex together and measure to the maximum load range.

Many rings are accurate to 0.1 lb and all rings measure accurately from zero loading to full range. Tension-measuring proving rings are also available.

The rings are made by Soiltest, Inc., Chicago, Ill.





Introducing a new type of "Armalon"

new "Armalon" FEP-fluorocarbon resin coated glass fabrics

After extensive development and testing, Du Pont now can offer "Armalon" FEP-fluorocarbon resin coated glass fabrics. The FEP resin has unique properties that enable this new "Armalon" to find applications in areas not appropriate to our regular TFE line of "Armalon".

Outstanding advantages of new "Armalon" FEP

- Uniform porosity resistance
- New lower melt point for easier lamination
- Good heat resistance
- Extreme toughness
- Abrasion resistance
- Excellent electrical properties over a wide range of temperatures and frequencies
- High degree of chemical inertness
- Smooth, anti-adhesive surface with anti-stick qualities

Comparison of properties of new "Armalon" FEP and "Armalon" TFE

PROPERTIES	FEP 503-108	TFE 403-108	FEP 505-112	TFE 405-112	FEP 506A-116	TFE 406A-116	FEP 510-128	TFE 410-128
Breaking Strength	65 x 40	45 x 35	130 x 65	75 x 60	160 x 160	90 x 90	260 x 220	200 x 175
Tear (Elmendorf)	16 x 6	10 x 5	21 x 8	15 x 10	13 x 14	12 x 12	49 x 39	40 x 40
Moisture Absorption	.23	.64	.18	.68	.30	.32	.276	.10
Burst	150	25	200	25	380	100	410	100

Characteristics of new "Armalon" FEP

The "Teflon" FEP-fluorocarbon resin coating on "Armalon" FEP gives this new material several outstanding properties (not provided by "Armalon" TFE). For example, the FEP resin has a lower melt point (545°F. to 563°F.) than the TFE resin. This recommends the use of "Armalon" FEP as a coating on glass fabrics that are to be heat-sealed. In addition, FEP dispersion-coated glass fabrics have lower permeability, greater breaking strength and lower moisture absorption than "Armalon" TFE.

You may want a material that doesn't crack when creased under moderate pressure. "Armalon" FEP won't. There is no known solvent for its FEP resin coating, and it is unaffected by aqua regia and all known chemicals except molten alkali metals. Corrosive materials and atmospheric conditions have no effect on it.

"Armalon" FEP remains flexible after long exposure to high temperatures, and pliable at temperatures lower than -100°F. Of particular significance are the improvements in burst strength and moisture absorption in the higher resin, lower glass qualities (see Qualities 503-108 and 505-112).

Suggested uses for new "Armalon" FEP

An important use for new "Armalon" FEP is in the wrapping and fusing operations for pipe covering, roll covering and chemically resistant containers. We also recommend these new materials for gaskets and specialized diaphragms, because of their satisfactory levels of uniform porosity resistance.

Industries that should find new "Armalon" FEP useful are aircraft, chemical, food processing, packaging, paper, plastics, printing, rubber, textile and various other industries.

FOR EXAMPLE: Conveyor belts used in baking, candy and food industries where sanitation and ease of release are important—Non-sticking covers for heat-sealing bars on packaging equipment—Diaphragms for regulators and control instruments where heat and chemical resistance are required. These are a few suggested uses for new "Armalon" FEP—there are many, many more. What application does this new product suggest to you?

For complete information on new "Armalon" FEP, its application and uses, write: E. I. du Pont de Nemours & Co. (Inc.), Fabric Sales, Wilmington 98, Delaware.

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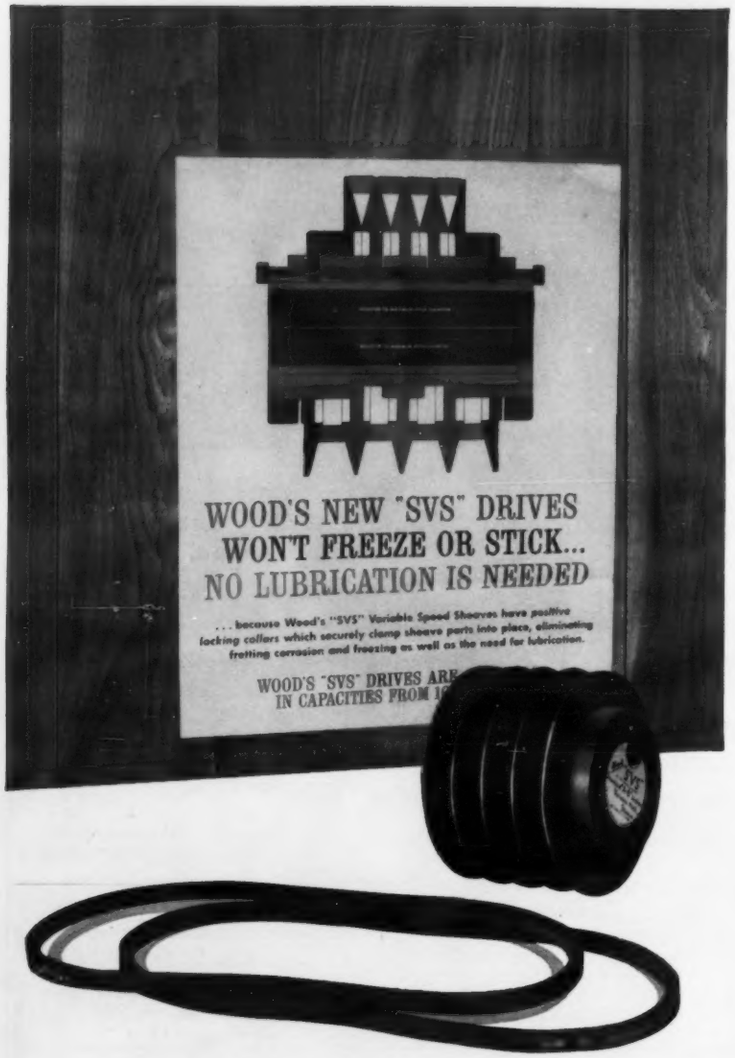
"ARMALON" COATED GLASS FABRICS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

"Armalon" is Du Pont's trademark for its FEP and TFE fluorocarbon resin-coated fabrics and laminates.

Circle 20 on Reader-Service Card for more information


WOOD'S NEW "SVS" DRIVES
WON'T FREEZE OR STICK...
NO LUBRICATION IS NEEDED
... because Wood's "SVS" Variable Speed Sheaves have positive locking collars which securely clamp sheave parts into place, eliminating fretting corrosion and freezing as well as the need for lubrication.

Wood's stationary control, variable speed drives, including SVS types, are available in capacities from fractional to over 300 hp using conventional v-belts. Wide range VPS types are available in capacities from 1 to 20 hp.

Write for BULLETIN 6102.

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SVS/2361

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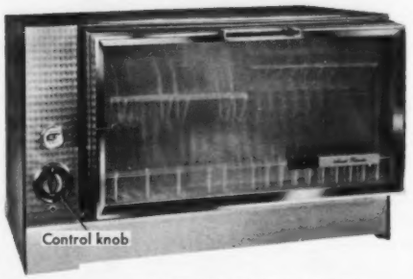
Two-Cycle Dishwasher Oscillates Water Wave

Victor W. Wigotsky, Eastern Editor



MOUNTED OR COUNTER TOP UNIT

COMPACT RECTANGULAR DISHWASHER is available in three models, accommodating service for 6, 10 or 15. Cabinet length of all units is 30 inches. Smallest unit is 13 inches deep and 15 inches high. Confining motor and control elements in compact, 4-inch-wide space maintains dish capacity. Loading efficiency is increased with parallel racking. Chassis slides out like drawer and is modular for easy servicing. Dishes are washed and steam-purified in two cycles requiring 25 minutes.

An oscillating slotted cylinder, containing a rotating impeller, produces a pressurized "wave of water" in a new dishwasher. A solid mass of high-velocity water is pivoted back and forth over a controlled area. Design functions in a continuous-flow system, which eliminates repetitive filling and draining during washing and rinsing.

Method is unconventional, both in washing action and cycle requirements. Dishwashers generally use either of two basic types of washing action. One is a vertical fan system in which water is sprayed upward to the dishes. The other is a recirculating pump system in conjunction with jet sprays. In both methods, water pressure is fed over the entire dishwashing area. Also, washing and rinsing require draining and refilling of the washwell.

The new dishwasher instead oscillates a "wave of water" over a controlled area so that the water pressure is not dissipated. A 24-inch-long impeller forces water through the cylinder slot, which is oscillated by a separate gear motor and linkage. The cylinder also functions as a filter which prevents recirculation of food particles, but allows fluid recirculation. Impeller forces water through filter holes (0.027 inch) in the cylinder as gear motor rotates the cylinder slot out of water in the washwell. This provides reverse flushing, which directs food particles to the drain area.

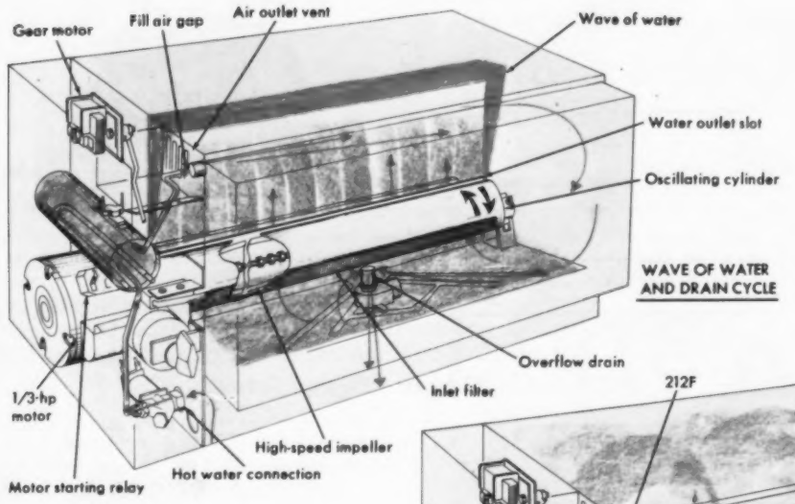
In addition to time saving, because of simultaneous washing, rinsing and draining, maintenance of a high level of water temperature is facilitated. The continuous flow cycle prevents the pipeline cooling during intermittent use.

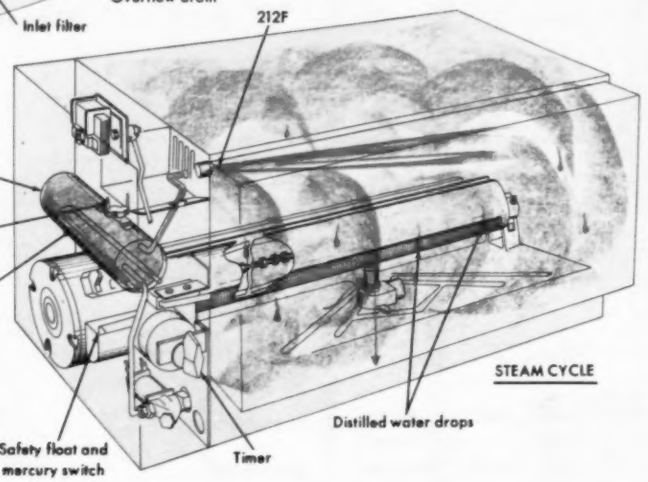
One-and-one-quarter gallons of water (capacity of washwell) are circulated constantly by the impeller and oscillating cylinder mechanism at a rate of approximately 100 gallons per minute. A solenoid valve, with a metering element, regulates addition of three quarts of water per minute. Thus, a continuous washing and rinsing action occurs during a 12-1/2-minute cycle without necessity for separate drain and refill cycles. Only nine gallons of water are used for the entire washing and rinsing operation in the framework of the single cycle.

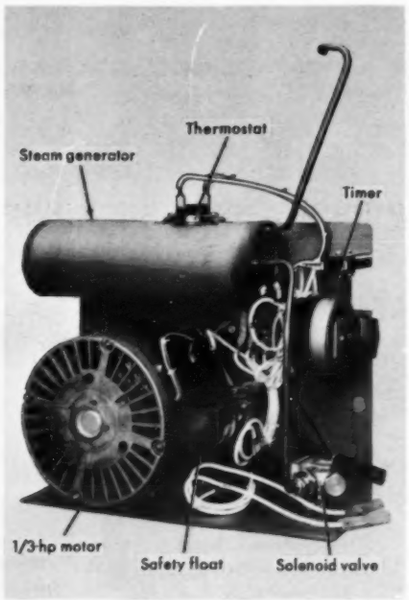
A second 12-1/2-minute steam cycle then steams the dishes and eliminates water spots. A steam generator, filled with three pints of water during the wash-rinse cycle, contains a 1250w heating element. Steam ejected throughout the dishwashing area fogs around the dishes and condenses to pure distilled water. Dropping of the distilled water results in dishes free of mineral deposits.

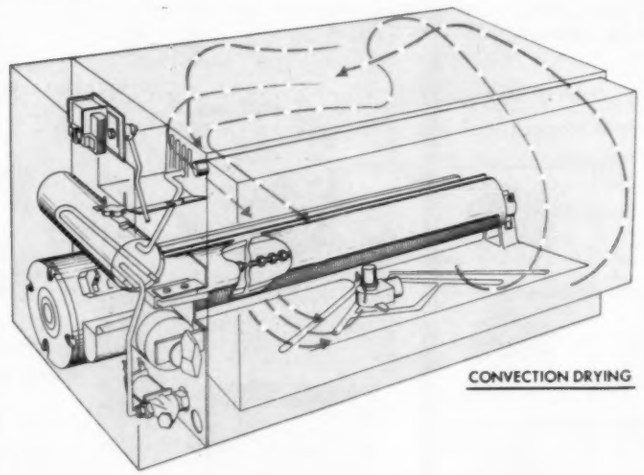
A significant feature of the new design is its versatility as either a quick-connect portable or an installed unit. The dishwasher is designed so that it can be conveniently mounted on a wall or counter, or maintained on a stand.

The Ling-Temco dishwasher is designed and manufactured by Temco Industrial Div., Ling-Temco Electronics, Inc., Dallas, Texas.

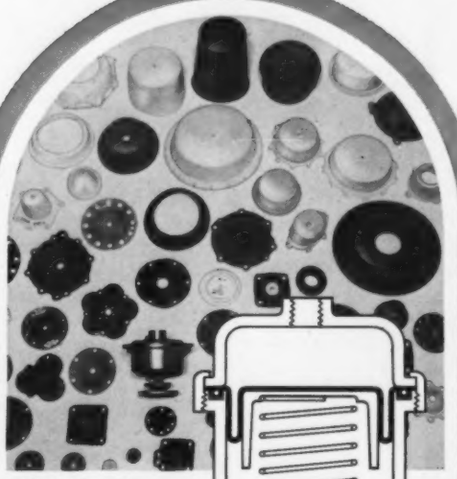








TURNING KNOB winds clock motor and closes SPDT switch which feeds current to solenoid valve, 1/3-hp motor and gear motor. Valve restricts flow to three quarts per minute. Steam generating tank fills for later use in drying cycle. Water then crosses inlet air gap and fills washwell until level reaches drain opening (1-1/4 gal). Impeller recirculates water through slot and produces effective flow rate of approximately 100 gal per minute. Gear motor oscillates cylinder through 90 deg, changing solid wave of water from vertical to horizontal sheet to provide pressurized sheet of water which traverses entire dishwashing area. Nine-and-one-third gallons flow into unit during 12-1/2-minute wash-rinse cycle, resulting in approximately seven water changes without delay in filling and draining. Same SPDT switch then stops motors, closes valve and connects heating element in steam generator. Large 1250w heating element is possible since motor shutoff avoids danger of circuit overload. Ejected steam then condenses on dishes and drains minerals. Heating dishes to approximately 200F has purifying effect and causes flash-drying when removed. If door is not opened, convection vents dry dishes when water drains.



Mr. Design Engineer:

we knock the "L" out of PROBLEMS

involving hydraulic or pneumatic systems

"Imaginative know-how!" That quality has made the name AERO GASKET synonymous with "success" in solving tough applications requiring diaphragms, or units employing diaphragms as the metering and/or sealing members. Aero Gasket has successfully designed diaphragms for pressures of fractions of inches of water to 3000 psi . . . for operation at temperatures from —65° to 600°F . . . and for any fluid media.

Whatever your problem, if the need is diaphragms, actuators, accumulators, metering or pressure sensing devices, you can look with confidence to Aero Gasket for the solution. Aero Gasket also designs and manufactures seals, gaskets, and precision parts of metal and/or molded materials. **SEND PRINTS AND DETAILS FOR PROMPT QUOTATIONS.**

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THE AERO GASKET CORPORATION
112 Hanover Street, Meriden, Conn.

☐ Please send me the Data Sheets describing Aero Gasket's diaphragms and diaphragm assemblies

I am also interested in:

☐ Seals and gaskets ☐ Precision molded parts
☐ Precision metal parts

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city_____ zone____ state_____

THE
AERO Gasket
CORPORATION
Meriden, Connecticut

DIAPHRAGMS • ACTUATORS • ACCUMULATORS
METALLIC & NONMETALLIC GASKETS
CLAMPS OF ALL TYPES AND DESCRIPTIONS
MOLDED RUBBER PARTS • METAL STAMPINGS • METAL-TO-RUBBER BONDING

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GRIPCO GUS
never forgets!...

Applications, that is. Thousands of them. Like this one: manufacturer was using bronze alloy nut, drilling through nut and stud and driving a pin to keep nut in place for a disc hinge connection. Gus looked into the problem, suggested Gripco* Toplock Nut in commercial brass. Tests proved the change perfect. Big saving in going from bronze to commercial brass and in eliminating the drilling of nut and stud, plus driving pin. No more breakage of small drills!

Could GRIPCO GUS and his application-savvy help you? There's one right in your own backyard, you know . . . and his services are *free*. You'll find him listed in the yellow pages under Bolts & Nuts as the GRIPCO representative (he'll be using his assumed name there).

Some of GUS' GANG:

GRIPCO CENTERLOCK NUT: Locking feature in the center for fast feeding. Can be applied from either end.

THE GRIPCO PILOT-PROJECTION WELD NUT: (3 or 6 projections) is designed for easy, quick positioning. The circular pilot automatically centers nut in hole of appropriate size, in part. No need for expensive jigs or centering devices. Pilot helps prevent weld spatter from entering nut threads. (With and without lock)

GRIPCO CLINCH NUT: With or without self-locking threads. Hex collar prevents turning when torqueing bolt.

Also available for immediate delivery: complete stock of Toplock, Open and Closed End Cap, Pilot- Projection Weld, Washer, Hex-Finished, Heavy Nuts, Self Piercing Clinch Nuts and Specials. 20-page Catalog on request.

*GRIPCO is a registered trademark of Grip Nut Co.

GRIP NUT COMPANY | *Subsidiary of Heli-Coil Corporation, Danbury, Conn.*

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3965

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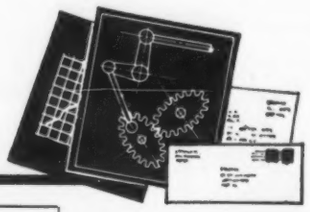
IDEA MART
DESIGN NEWS

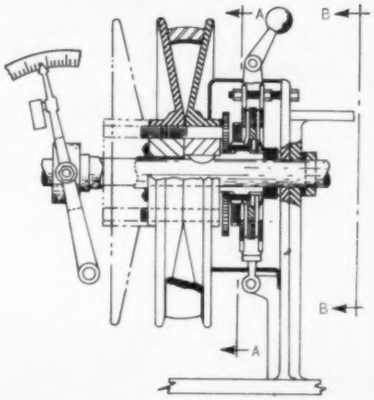


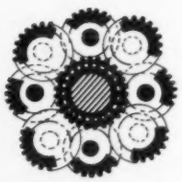
Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

AVAILABLE

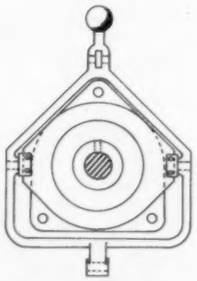
Variable Sheave—Power Actuated

This variable sheave for variable-speed drives does not require an auxiliary motor, sprockets and chains, or thrust bearings. The pitch diameter is varied by means of power taken from its own shaft and may be manually controlled or controlled by remote means. The design is suitable for single or multiple V-belts. The design is patented, and license is available. Write IM 541, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.





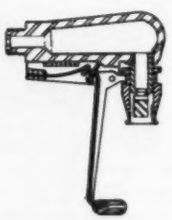
SECTION A - A



SECTION B - B

AVAILABLE

Push-Back Faucet



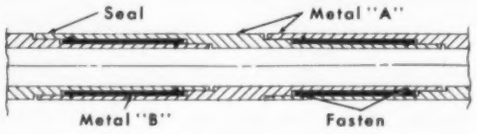
SECTION A - A

This push-back faucet is designed to withstand long periods of hard service without frequent servicing or adjusting. Specific application is for restaurant or similar service where liquid must be dispensed quickly without splashing. Under average water pressure conditions, a 4.5 glass will fill in 2 sec. The device is composed of one brass casting, chrome- or nickel-plated, two metal stampings and three screw machine parts plated to match. Write IM 539, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

AVAILABLE

Structural Member With Thermal Coefficient Of Expansion of Zero

This structural member is a laminated bimetal pipe fabricated as illustrated. Pipe sections are fastened by welding or other means at points indicated. Material B has a higher coefficient of expansion than material A.



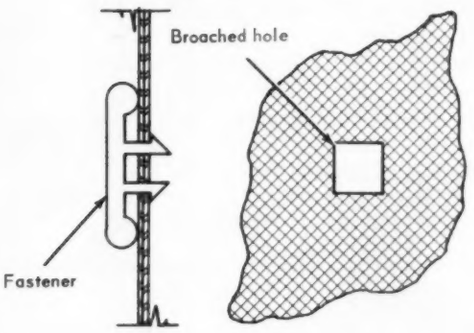
If lengths of pipe sections are correctly chosen with respect to coefficients of expansion, overall coefficient will be zero since A and B act in opposite directions and thus compensate. Possible materials are as follows:

TYPE	MATERIAL	COEFFICIENT OF THERMAL EXPANSION / deg C ($\times 10^{-6}$)
A	Sterling stainless steel A	10.3
A	Enduro KMI	9.99
A	Carboloy	6
A	Molybdenum	4.9
A	Ferronickel (valve steel)	4.0
B	Aluminum (zinc alloy)	26.0
B	"Dowmetal" magnesium alloy	27

Although these structural members would probably be more expensive than conventional members, some applications would justify their use. Similar constructions can be made of nonmetallic materials. Write IM 538, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

AVAILABLE

Self-Retaining, Self-Locking Fastener



This low-cost fastener may be made by saw cutting a nylon extrusion. Inserted in a broached hole, the device is self-retaining as prongs grip the edges of the hole. Prongs exert a force against the sides of the hole and lock the fastener against vibration in the panel and spring action of the external wings clamp the panel to the structure. Head style may vary so that it may be operated by finger pressure or by a tool. Wish to sell or license. Write IM 540, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.

New Warner ELECTRO-PACK Clutch Brake Drive with torque ratings of 10, 60, and 240 lb-in.

WARNER Electro-Pack CLUTCH-BRAKE DRIVE

Complete new "package drive" puts automatic cycling on your machines without engineering . . . without machining!

Preassembled! Prealigned!

Just bolt it down and wire it up!

This ready-to-install Warner "package drive" gives you a fractional hp clutch-brake unit assembled and ready to couple to an input and output shaft. Simply bolt it in place, hook up the lead wires and it is ready to go—*without* costly engineering or machining!

Rugged, reliable design

Lightweight and compact, the ELECTRO-PACK delivers high-cycle performance with rapid heat dissipation and freedom from maintenance. Sturdier, widespread, long-life bearings run cooler under all conditions.

Simple assembly, standard components

The ELECTRO-PACK incorporates *standard* Warner units, available all over the world. Service is simple, alignment fast and positive.

WARNER ELECTRIC

Get detailed specifications on this new Warner Electro-Pack Clutch-Brake Drive Package—fill in and mail coupon now.

WARNER ELECTRIC

Warner Electric Brake & Clutch Co., Dept. DN-12, Beloit, Wisconsin

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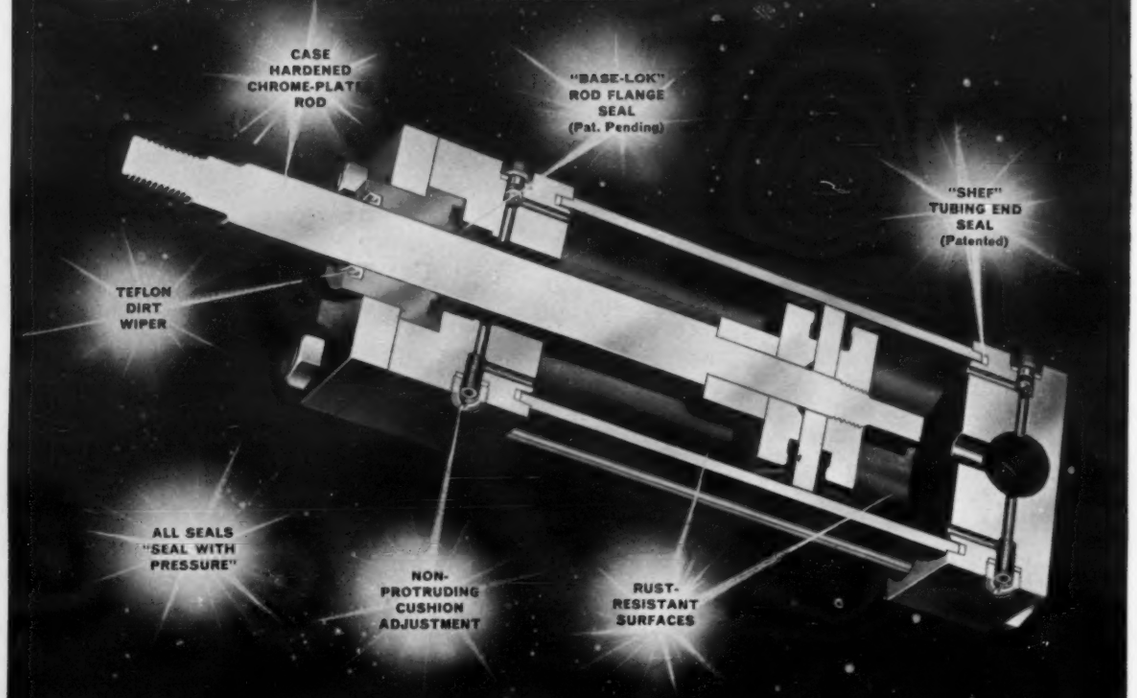
Stellar RELIABILITY and ECONOMY


CASE HARDENED CHROME-PLATED ROD
"BASE-LOK" ROD FLANGE SEAL (Pat. Pending)
"SHEF" TUBING END SEAL (Patented)
TEFLON DIRT WIPER
ALL SEALS "SEAL WITH PRESSURE"
NON-PROTRUDING CUSHION ADJUSTMENT
RUST-RESISTANT SURFACES

Miller AIR CYLINDERS

PORT SEALS

Now—with every Miller Cylinder—Teflon-sealed Port Seals that "Seal with pressure" are provided as standard at no extra cost. They permit much faster positioning of lines and fittings, eliminate "overtightening" damage, and seal perfectly against all operating media.

Here are eight more reasons why Miller Air Cylinders continue to be the most economical and reliable cylinders that money can buy. These stellar features—including the new port seals—are standard Miller construction—yours at no extra cost. Thus, they provide appreciable savings in original investment—*particularly for those who insist on "J. I. C." quality throughout.* Savings in operating costs are even greater, because these features are proven assurance of longer cylinder life, greater efficiency, reduced maintenance and downtime.

Specify "Miller" for greater reliability and economy! Write for bulletin.

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DIVISION OF MILLER-REES CORPORATION
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AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

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PATENTS

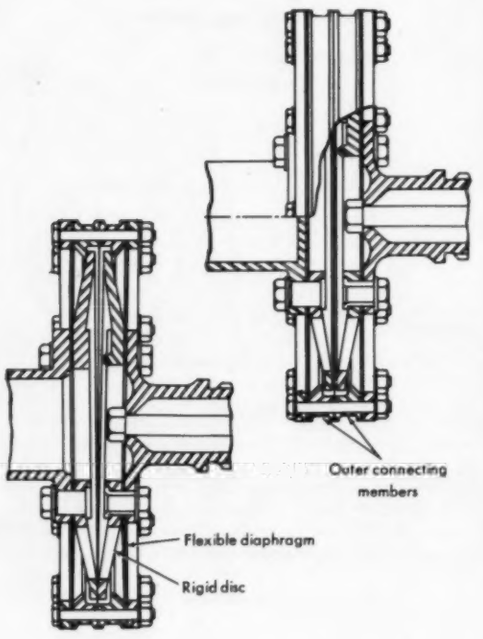
Shaft Coupling

U S Patent 2,997,863; Walter N. Stone, Bloomfield, and Nelson R. Richmond, Thompsonville, Conn., assignors to The Kaman Aircraft Corp., Bloomfield, Conn.

Allowing angular misalignment of two shafts, this coupling also limits the extent of misalignment without impairing torque-transmitting capacity. Either shaft may be the driving shaft. Power is transmitted from the driving shaft, through a thin flexible circular diaphragm and rigid outer connector, thence through a second diaphragm to the driven shaft. The diaphragms are substantially parallel.

The outer connecting members include circular flanges to which the diaphragms are bolted. Bolts extend through the edges of the diaphragm and through the connecting flanges, holding all parts fixed.

The limiting means is provided by two similar rigid discs fixed one to each shaft. Discs are adjacent to diaphragms. Annular surfaces are provided at the peripheries of the discs. The surfaces are spaced from each other when the shafts are in alignment. When shafts are misaligned, the surfaces meet at a point on the periphery. Annular surfaces also are provided on the outer sides of the discs, and contact surfaces formed on the outer connecting members when the shafts are misaligned.

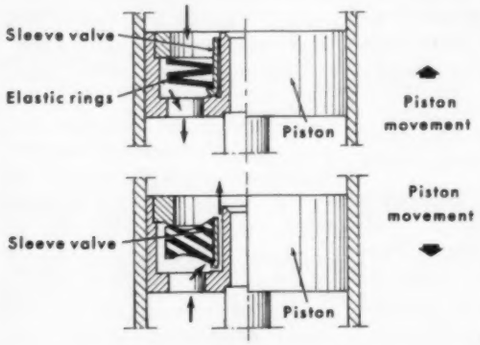


Two-Way Bleed Valve

French Patent 1,244,909; Louis Béchereau, Paris, France.

This two-way valve is designed for installation in the piston of a shock absorber. The active valve element is either a stack of Belleville washers or a rubber ring.

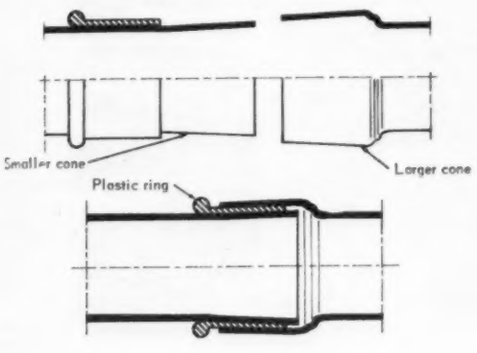
Placed in an annular chamber ported to both sides of the piston, the valve element normally seals against abutments with its inner and outer ends. When the piston moves forward, increased pressure ahead of it deflects the valve element from its outer seat. Similarly, return movement lifts the element off its inner seat. In both cases the small flow section provides the desired retardation.



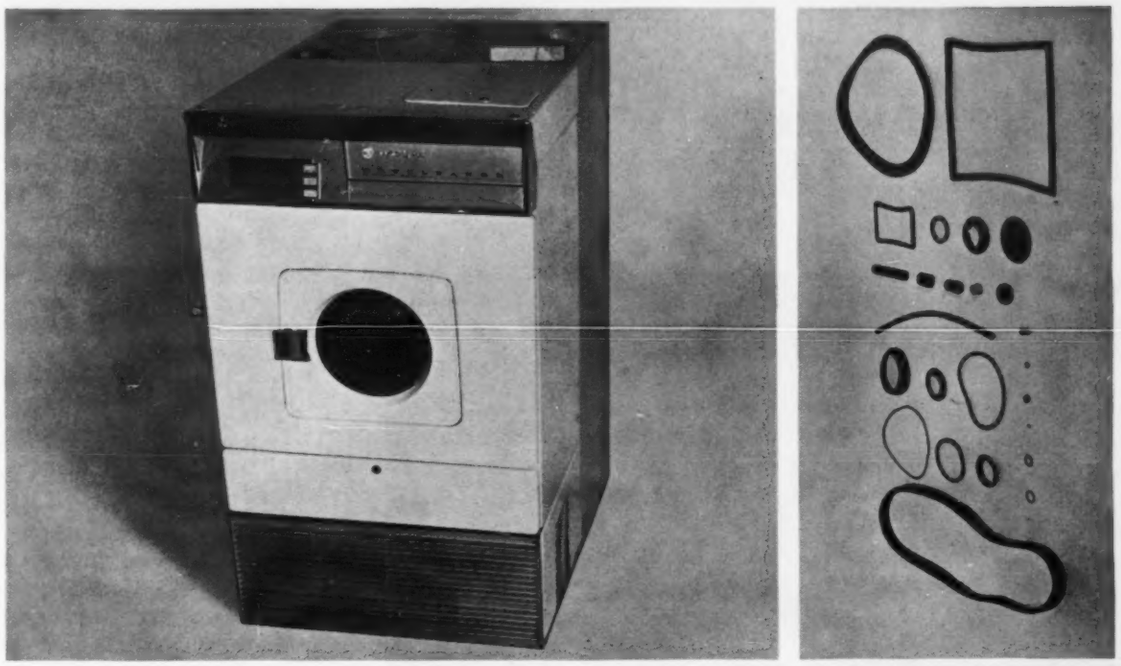
Pipe Coupling

French Patent 1,245,751; Jacques Chaplin, assigned to Pechiney Co., Paris, France.

This assembly is designed for rapid coupling of pipes which can be put under tension. Mating ends are flared with tapers which allow one to fit inside the other. A plastic sleeve is pushed along the pipe with the smaller cone after it has been placed in the larger cone. When pushed completely into the coupling, the plastic sleeve forms an elastic seal whose efficiency increases with the magnitude of tension applied.



Why Engineers Selected VITON® as Material "X" for the RCA Whirlpool Dry Cleaning Machine



Twenty-five parts (right) are made of VITON to withstand solvent and high heat

Whirlpool Corporation engineers solved staggering problems in developing a foolproof coin-operated dry cleaning machine. One of these problems was searching for a Material "X" that would withstand constant attack by the cleaning solvent.

Perchlorethylene ruins flexible seals, gaskets, tubes and valves made with conventional materials. The compact machine's six separate systems (electrical, mechanical, air flow, solvent, refrigeration and coin), make many additional elastic components necessary for insulation and damping.

In these applications, ordinary rubber stiffens, swells and breaks down in a matter of days.

"We tested many materials," reports Robert K. Sykora, director of engineering for Whirlpool's commercial laundry and dry cleaning equipment division. "One by one they were eliminated until VITON synthetic rubber was tried.

"We found that VITON not only withstands perchlorethylene, high temperatures and general wear, it retains its resilience and tensile strength despite prolonged use. And VITON doesn't bleed color when exposed to the hot perchlorethylene vapor . . . a most important feature where clothing is involved."

VITON defies a host of other rubber-destroying fluids as well, including fuels and lubricants. Special compounds can function all the way up to *600° F.* If your design problem involves resilient seals, O-rings, diaphragms, or hoses that must function under extraordinary conditions, you should check VITON.

For details and a list of reliable rubber manufacturers who can engineer VITON parts to meet your needs, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-12, Wilmington 98, Delaware.

DU PONT VITON® SYNTHETIC RUBBER

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What's new in drafting materials? Get it firsthand from Dietzgen

Today's engineering and production achievements are miracles of teamwork. The talents of scores, hundreds and even thousands of engineers, architects, technicians, draftsmen, and specialists are coordinated through rapid and accurate interchange of ideas. Technical drawings are the primary communication media of this progress and their preparation represents approximately 70% of the total engineering costs.

Dietzgen's long experience and continuing research plays an important part in providing new techniques, materials, and equipment to boost drafting room efficiencies. For example: Dietzgen "no-print" gridded drafting media promote faster, more accurate sketch work and eliminate many tedious re-drawing operations. New Dietzgen sensitized drafting media have pioneered such time-saving cost-cutting techniques as template drafting, registration drafting, and new methods for retrieving drawings which have lost their line density.

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Write today for the new Drafting Media brochure. This 28-page booklet not only presents what's new in drafting materials, it also explains and illustrates their many uses. Address your request on your company letterhead and ask for Publication MKTG3-M91.
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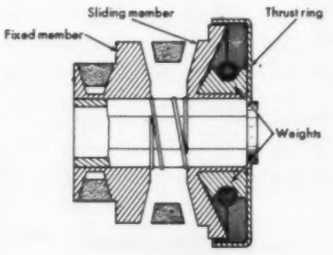
PATENTS

Centrifugal Pulley Clutch

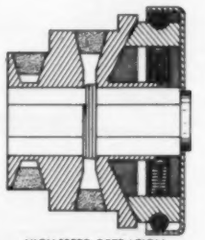
British Patent 866,550; Wolseley Engineering, Ltd., Electric Ave., Witton, Birmingham 6, England.

Weights, held by a weak garter-type spring tending to restore them to rest position at idling speeds, actuate a simple, economical pulley clutch. The weights are housed in a pocket between a thrust ring and a sliding pulley member with inclined outer face. Each weight has a plane side seated against the thrust ring and an inclined side making face-to-face engagement with the similarly inclined surface of the sliding member. In operation, increasing speed moves the weights outward and the plane sides ride up the thrust ring. The inclined sides coact with the sliding member to displace it toward the fixed pulley member.

The pulley-driven fixed member is mounted on a tubular spindle with hexagonal outer end carrying the integral sliding pulley sleeve. A light coil spring urges the sliding member away from the fixed member to a position corresponding with idling conditions.



LOW-SPEED OPERATION


HIGH-SPEED OPERATION

Circle 27 on Reader-Service Card

The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

FLEXIBLE COUPLING AND SEAL THEREFOR
U S Patent 3,001,385; Edward E. Allen, Erie, Pa., assignor to Zurn Industries, Inc., Erie, Pa.

TORQUE-TRANSMITTING SLIP JOINT
U S Patent 3,001,387; Raymond J. Schultz, Bay City, Mich., assignor to General Motors Corp., Detroit, Mich.

FLUID METERS
U S Patent 3,001,400; Pieter de Graaf, Dordrecht, Netherlands, assignor to N. V. Vloeistofmeetapparatenfabriek, Rotterdam, Netherlands.

ACCELEROMETER
U S Patent 3,001,406; Frederick A. Oyhus, Rockville, Md., assignor to the United States of America as represented by the Secretary of the Navy.

POWER TAKE-OFF
U S Patent 3,001,409; Cyril W. Von Fumetti, Dubuque, Iowa, assignor to Deere & Co., Moline, Ill.

OSCILLATION OR INERTIA DAMPER
U S Patent 3,001,419; Harold Hymans and Jafar Devlet-Muraz, Paramus, N. J., assignors, by mesne assignments, to the United States of America as represented by the Secretary of the Navy.

BALL PLANETARY DRIVE UNIT
U S Patent 3,001,420; Vern S. Juenke, Reno, Nev., assignor to Nevada Air Products Co., Reno, Nev.

PUMP
U S Patent 3,001,481; Walter N. Thompson, Mont Vernon, N. H., assignor to Improved Machinery, Inc., Nashua, N. H.

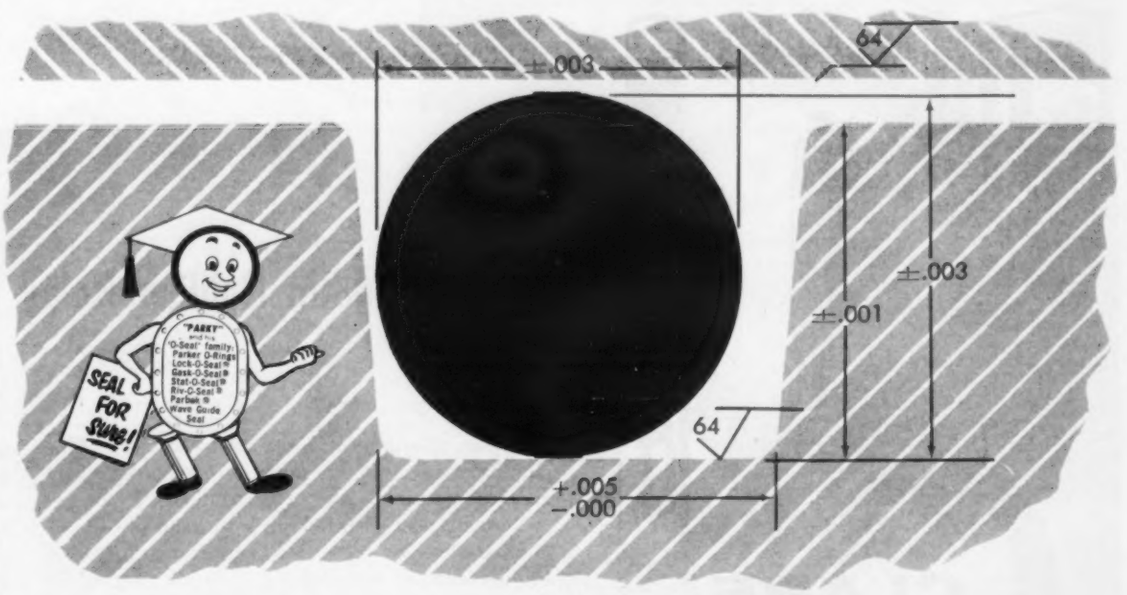
CHECK VALVE
U S Patent 3,001,546; Clifford A. Salisbury, 1110 N. Main St., Tonkawa, Okla.

TORQUE DISCONNECT
U S Patent 3,001,620; Joseph M. Olchawa, Chicago, Ill., and Homer J. Wood, Sherman Oaks, Calif., assignors to Foote Bros. Gear & Machine Corp., Chicago, Ill.

SHAFT DRIVE COUPLING
U S Patent 3,001,621; Jerome G. Burns, Media, Pa., assignor to International Resistance Co., Philadelphia, Pa.

CENTRIFUGAL CLUTCH
U S Patent 3,001,623; Thomas L. Fawick, Cleveland, Ohio, assignor to Fawick Corp.

ELLIPTICAL BEARING
U S Patent 3,001,840; C. Walton Musser, Beverly, Mass., assignor to United Shoe Machinery Corp., Flemington, N. J.



Cancel These Tolerances Specify GASK-O-SEALS®!

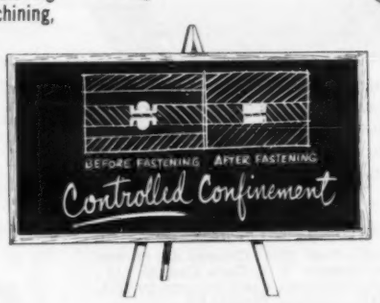
There are more than 5 vital dimensions in the standard O-ring-in-groove installation. Just one of these dimensions, if out of tolerance, can cause an imperfect seal and a resultant leak. Moreover, these tolerances can build up adversely **without always being detectable.** For instance, the total build up in a regular static o-ring gland design amounts to as much as 51% of cavity. It's only 3% in a Gask-O-Seal!

The problem of tolerances is eliminated when you use Gask-O-Seal . . . It's taken care of in its unique design and manufacture using the principle of **controlled confinement.** Gask-O-Seals eliminate 95% of inspection time. **Absolute reliability is built-in.**

In addition, Gask-O-Seals provide metal-to-metal contact, low fastening torques, visual inspectability after installation, no groove machining, and re-usability.

All of this means real no-leakage dependability . . . **the utmost in gasket reliability.**

Why not get **all** the facts about this versatile no-leakage seal. We'll be glad to send you complete information.



THE VERSATILITY OF GASK-O-SEALS IS SHOWN BY ABOVE SAMPLES — ONE OF THEM SEALS 3 DIFFERENT MEDIA AT 9 POINTS — ALL IN ONE GASKET!

Parker SEAL COMPANY
Culver City, California and Cleveland, Ohio

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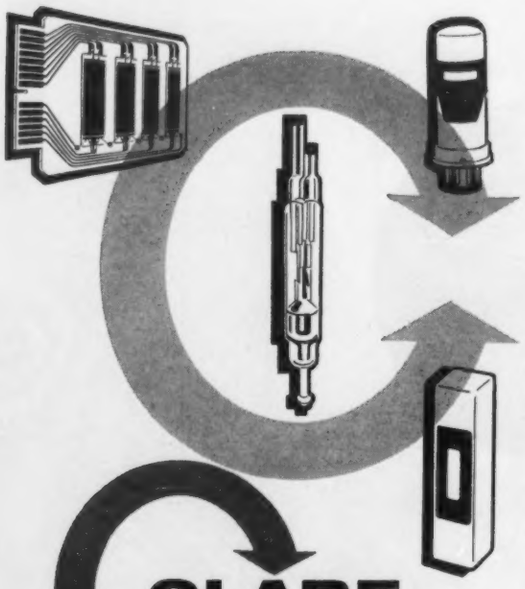


CLARE

Mercury-Wetted Contact Relays

... flexible to meet every requirement

Clare mercury-wetted contact relays are available in printed circuit assemblies, modules, conventional plug-in relays and special assemblies. Either of two basic switch capsules... HGS for especially fast, sensitive operation or HG for higher contact loads... is provided. These relays are tested for billions of maintenance-free operations. They never get out of adjustment, never bounce or chatter.

The Mercury-Wetted Principle

The remarkably long life of CLARE mercury-wetted relays is the result of a design principle whereby a film of mercury on the contacts is constantly renewed, by capillary action, from a mercury pool. Switches are sealed in a glass tube in high-pressure hydrogen atmosphere.

For complete data write for Design Manual 201-A

C. P. CLARE & CO., 3101 Pratt Blvd., Chicago 45, Illinois.
In Canada: C. P. Clare Canada Ltd., 840 Caledonia Road, Toronto 19, Ont.
Cable address: CLARELAY.

C. P. CLARE & CO.
Relays and Related Control Components

Circle 29 on Reader-Service Card for more information

Builtin Holding Relay Reduces Delay Timer's Cost

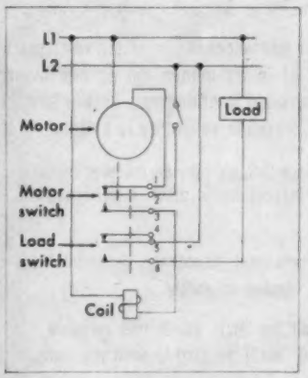
Victor W. Wigotsky, Eastern Editor

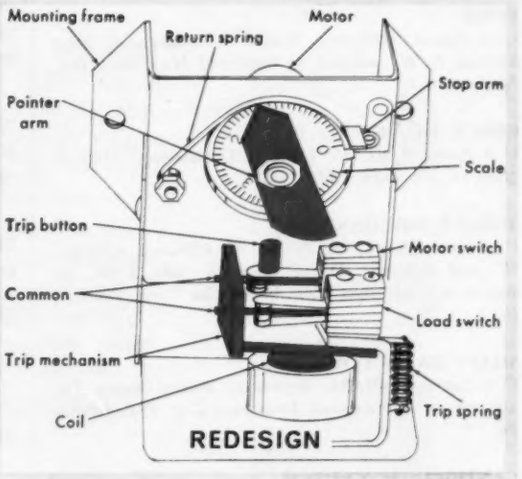
A holding relay is built into a new delay timer. This eliminates necessity for a separate auxiliary relay and reduces overall cost by better than 20 percent.

Normally, an SPDT switch functions with an auxiliary holding relay. This permits the motor to be de-energized and the trip arm to reset while power is still available for the load. Use of the trigger switch and auxiliary relay arrangement results in additional cost, as well as inconvenience to the customer, who had to install the holding relay after purchase of the timer.

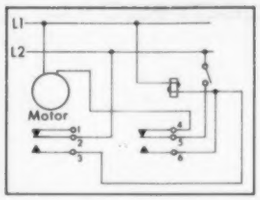
In the redesign, a single DPDT switch is used instead of the previous two-switch arrangement. One pole of the switch functions as the motor and coil control; the other pole is used for load control. In operation, a pointer arm actuates a button on the top leaf of the motor switch. When the button is sufficiently depressed, the normally closed contact of the motor switch forces the common down on the normally open contact. The latter then energizes a coil which pulls the common away from the normally closed contact, de-energizing the motor and allowing the trip arm to reset through a return spring. Energizing of the load also is accomplished as a result of the transfer of the trip mechanism by the coil. Since the holding relay is built into the timer, a significant cost saving results. In addition, the unit is complete, without necessity for the user to mount and wire an auxiliary relay into the timing system.

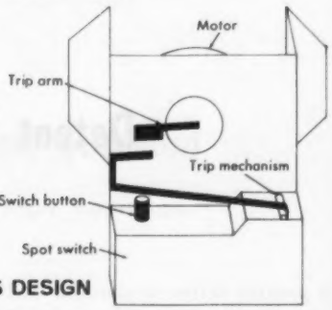
The Model BN-21 Delay Timer is designed by Haydon Div. of General Time Corp., Torrington, Conn.





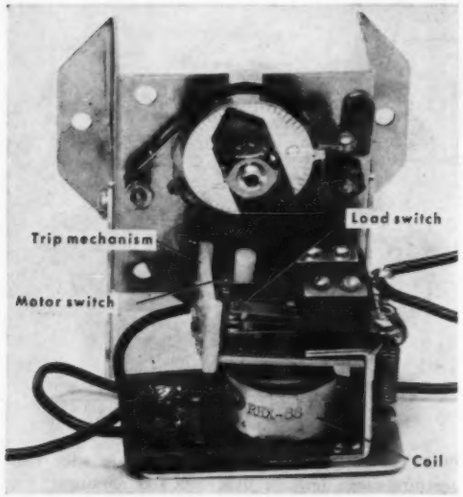
BUILTIN HOLDING RELAY of redesign reduces cost of overall timer package. Unit maintains reliable method of mechanical actuation and electrical lock-in. Closing sustained contact switch runs timer (switch-2-1-motor). Setting of pointer arm using scale and lock nut establishes time range. Arm winds return spring and acts against trip button. Coil is energized (switch-2-3-coil) when normally open (terminal 3) element of motor switch is tripped. Trip mechanism is pulled toward coil, transferring (5) from (4) to (6) and breaking contact between (2) and (1). Motor switch is make-before-break. This de-energizes motor, allowing it to reset through return spring until stop arm is reached. At same





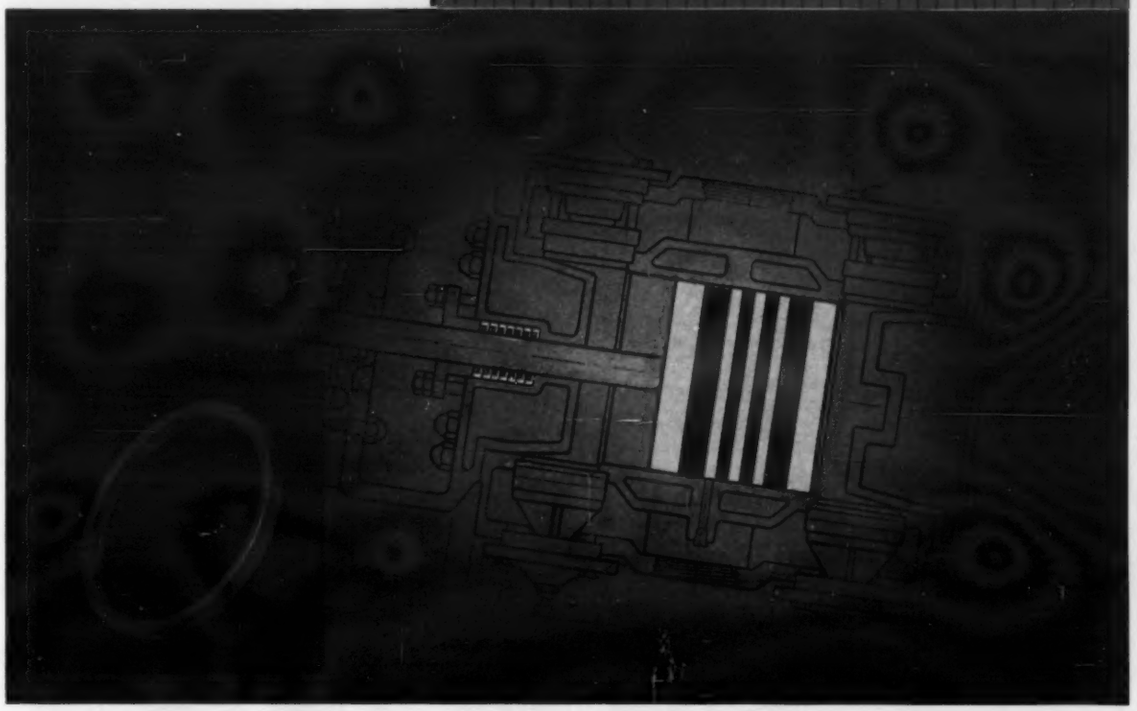
PREVIOUS DESIGN

AUXILIARY RELAY (bought separately by customer) in original design provides holding circuit which permits motor to reset while load is energized. Sustained contact switch is closed, starting motor (5-4-M). Trip arm actuates SPDT switch. As (2) is transferred from (1) to (3), coil is pulsed (2-3-coil). This trips (5) from (4) to (6) and provides holding circuit (5-6-coil). Since (4) is deprived of current, motor is de-energized and resets trip arm through return spring. If auxiliary relay switch were not connected, motor would be de-energized when it broke contact with normally closed terminal (1). When switch returned, it would energize motor again, resulting in rapid succession of pulses. Coil is energized until sustained contact switch is opened. Load would be wired in parallel with coil off terminal (6).



time, load is energized (5-6-load). Coil is de-energized when sustained contact switch is opened. Released trip mechanism returns to position through trip spring. This de-energizes load and timer is ready for another cycle.

DU PONT TEFLON®



How piston rings of TEFLON® saved $1,600 per year in compressor maintenance alone

CAN YOU AFFORD NOT TO USE TEFLON?

- Piston rings of TEFLON are your most economical choice whenever product contamination is a problem . . . whenever maintenance costs should be cut . . . whenever lubrication should be reduced or eliminated.
- Rings of TEFLON can permit bone-dry operation . . . provide more uniform output because there is less gas blow-by . . . reduce danger of fretting, galling and cylinder wear.
- Rings of TEFLON are not brittle . . . resist chipping, cracking, breaking . . . installation, storage and handling are easier.
- Rings of TEFLON make possible substantial savings in operating, maintenance and replacement costs.

In a plant manufacturing chemical intermediates, a two-stage compressor handled ethyl chloride. In this service, standard carbon piston rings required constant lubrication and maintenance during their average life of 2,000 hours. Conversion of this unit to piston rings of a TEFLON TFE resin had dramatic results. These rings operated for 10,000 hours without maintenance. Lubrication and product contamination were eliminated. On this one compressor, the plant saved $1,600 in maintenance costs alone.

Such savings and improvements are typical of those provided by rings of TEFLON. If you are buying a new compressor, specify rings and packings of TEFLON. To convert your present equipment, check with your compressor manufacturer or qualified ring supplier for engineering and design assistance. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. DN-12-T, Room 2526, Wilmington 98, Del. *In Canada*: Du Pont of Canada Limited, Box 660, Montreal, Que.

DU PONT TEFLON® FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Circle 30 on Reader-Service Card for more information

What's News in Plastics...

Molded by Pearce-Simpson, Inc., Molded Plastics Division, Miami, Florida

Dishwasher cradles of Escon® polypropylene defy high heat and detergents

The Jackson Products Company of Tampa, Florida, chose Escon polypropylene for the conveyor-belt cradles on its new flight-type dishwasher. Resistance to high heat and detergents was the overriding reason. Of all materials considered (including metals and other plastics), Escon best withstood the punishing chemical attack of wetting agents found in commercial dishwashing compounds.

The resilience of Escon creates a cushioning effect which minimizes breakage, while its negligible water absorption contributes to long life. And with Escon, cradles can be made in a variety of contrasting colors.

Properties like these point to Escon polypropylene as the ideal choice for many demanding applications. To find out more about this versatile material, write to Enjay, 15 West 51st Street, New York 19, New York.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

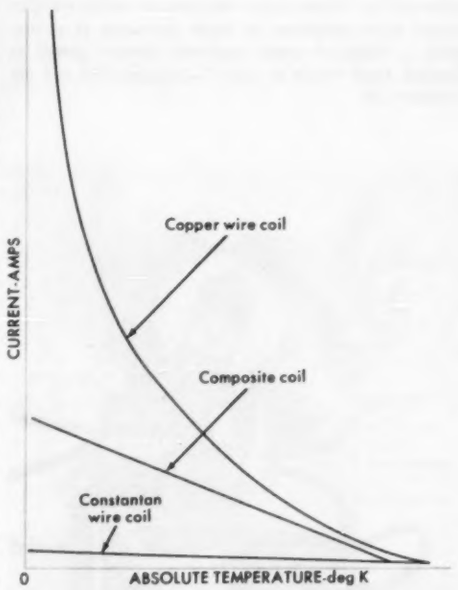
ENJAY

Circle 31 on Reader-Service Card for more information

Detent Latches

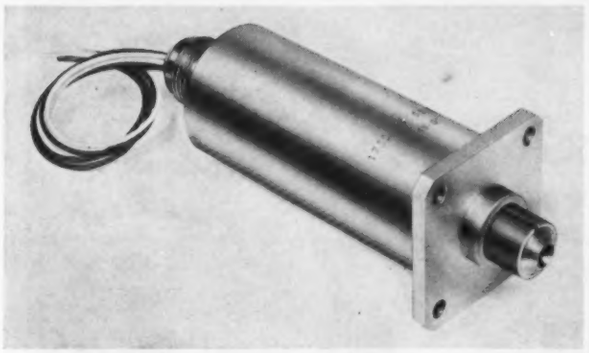
A positive detent mechanism latches a d-c pull solenoid for cryogenic service. The dual-coil solenoid operates a liquid hydrogen shut-off valve in the Atlas-Centaur Booster.

Coil 1 pulls the shut-off plunger when it is energized with a pulse of 1 sec or more duration. The detent latches this plunger in its retracted position. An electrical pulse to the second coil unlatches the plunger, allowing it to extend.



PLOT of current versus temperature over wide temperature range (greater than 100C) is nonlinear. For inferred zero resistance of copper at zero degrees Kelvin, current is asymptotic for copper wire. Constantan wire has much higher resistance than copper, therefore draws less current at near zero degrees Kelvin. Composite coil using constantan and copper wire therefore limits current to reasonable value at cryogenic temperatures.

Cryogenic Solenoid

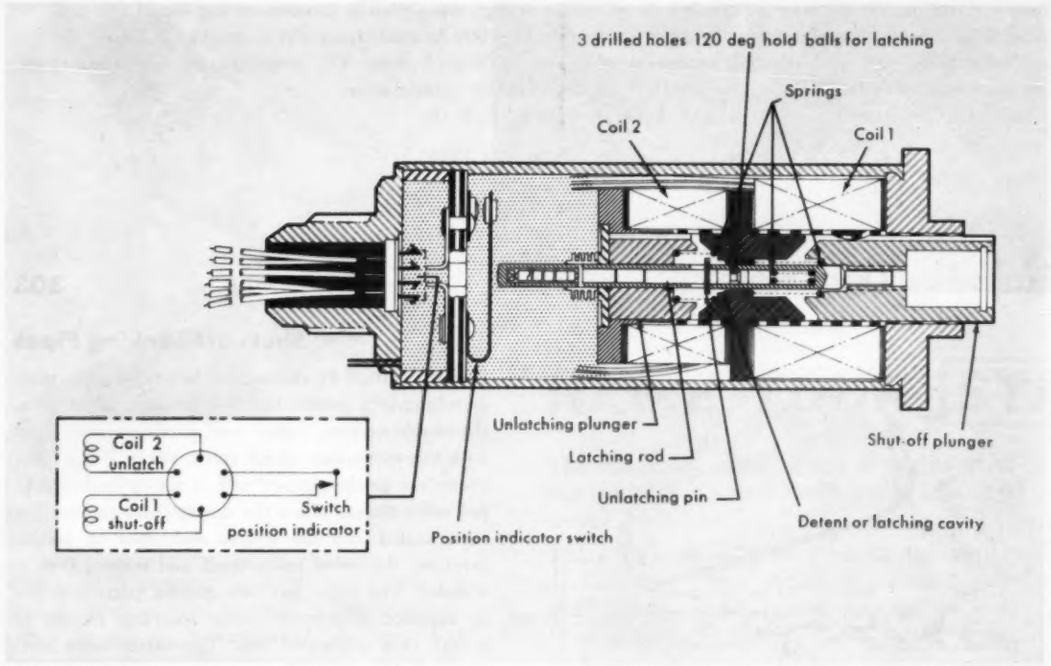


CRYOGENIC SOLENOID is hermetically sealed for liquid hydrogen cryogenic service. It is rated for continuous duty at 18 to 30v d-c. It has 4.5-lb force pull at 0.1-inch stroke operated at 24v d-c and room temperature.

Edward W. Schrader, Western Editor

Both coils have special windings to compensate for an ambient temperature range of —422F to +160F. The current drain at room temperature is 2.0 amps maximum, and it is 5.5 amps maximum at —422F. The special coil design limits current drain at the extremely low temperature. Each coil has two windings connected in series; one winding is copper wire, the other winding is constantan wire. Constantan has approximately 20 times the electrical resistance of copper at room temperature and its resistance versus temperature over a wide range is nearly constant.

The cryogenic latching relay is a design development of IMC Magnetics Corp., Western Div., Maywood, Calif. The Atlas-Centaur Booster is being produced by the Astronautics Div. of the General Dynamics Corp. for the National Aeronautics and Space Administration.

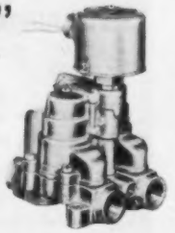


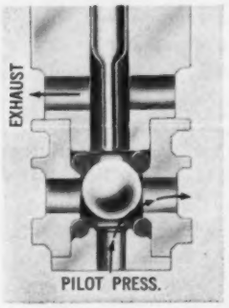
LATCHING SOLENOID holds shut-off plunger in retracted position when coil 1 is energized. As shut-off plunger retracts, spring pushes latching rod to hold balls in detent groove. When coil 2 is energized, unlatching plunger moves in opposite direction to meet unlatching pin fixed in latching rod to move rod, thus releasing balls in detent and allowing shut-off plunger to extend when balls fall out of detent and drop into groove on latching rod. Extreme end of shut-off plunger assembly contacts position indicator switch to give electrical signal to remote location of plunger position.

EXCLUSIVE!

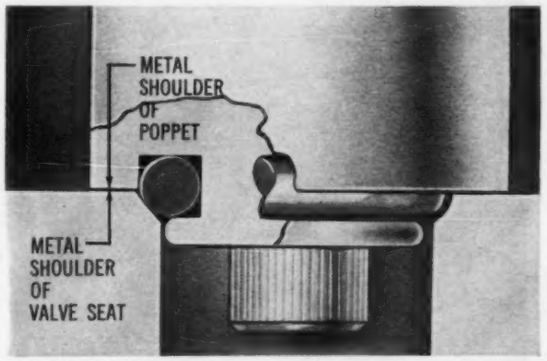
"NO 'O' RINGS TO STRANGLE THE PILOT PLUNGER OR MAIN VALVE POPPET"

This can be said about only one solenoid pilot air valve





The pilot plunger of the CRESCENT® "Mach 2" air valve requires no "O" rings. A free-moving ball in the pilot cartridge makes the seal. No "O" ring drag on the plunger; no friction; no wear.



The main poppet seals are merely kissed by the sealing surface in the sealed position. Metal shoulders take the shock, metal against metal. 'O" rings are only minutely flexed; do not fatigue or lose resilience. Where else can you find a poppet valve where a metal piece doesn't come crashing down on a rubber seal causing wear?

"MACH 2" OFFERS OTHER EXCLUSIVES. Get the whole story. Call your Barksdale representative or write for catalog.

CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

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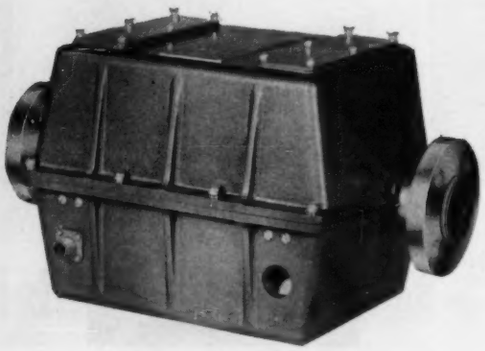
DESIGN NEW PRODUCTS NEWS

Circle number on Reader Service card for more information

Electromagnetic Flowmeter 301

Measures Any Liquid

Featuring an electromagnetic flow measurement technique, the meter responds to fluid velocity only, providing true volumetric reading. The unit is suitable for use with a wide variety of fluids, including inconsistent slurries or viscose, and shows no more pressure loss than the equivalent length of pipe. The flow transmitter is a straight pipe operating in a magnetic field created by field coils. The tube is of nonmagnetic stainless steel lined with an insulating corrosionproof "Teflon" liner. Stainless-steel electrodes mounted in a plane at right angles to the magnetic field conduct the signals generated by the moving fluid to a high input impedance preamplifier. The flow signal from the preamplifier is compared with a feedback voltage from a rebalancing slide wire supplied with a reference voltage from the

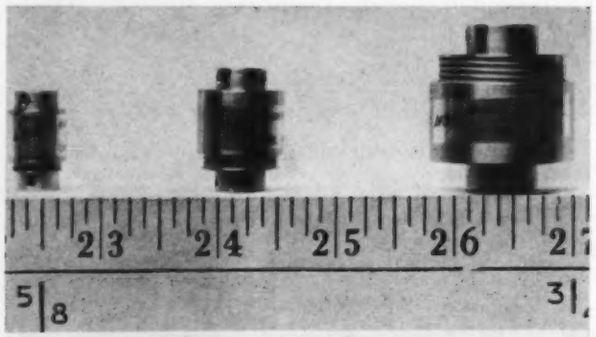


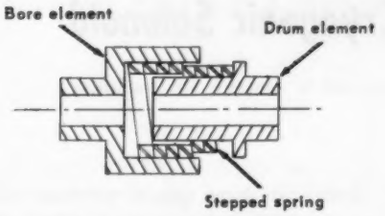
coils. Because comparison is made at the preamplifier input, gain of the amplifier is not critical. Because the slide wire reference voltage is obtained from the same source as the magnetic field, the system is largely independent of line voltage or frequency fluctuations. The preamplifier for the unit has an extremely high input impedance with a common mode noise rejection ratio of more than 3000:1. Depending upon the conductivity of the fluid being measured, the preamplifier may be located as far as 1000 ft from the transmitter head. The flowmeter transmitter has a flow tube with a 1-inch nominal ID and is fitted with 150-lb ASA flanges. The flowmeter has a three-step range adjustment—10, 50 and 100 gpm full scale with an accuracy of 1/2 percent of full-scale calibration.

Hays Corp., 742 E. 8th St., Michigan City, Ind.

Slip Coupling 302

Designed for Continuous Slip





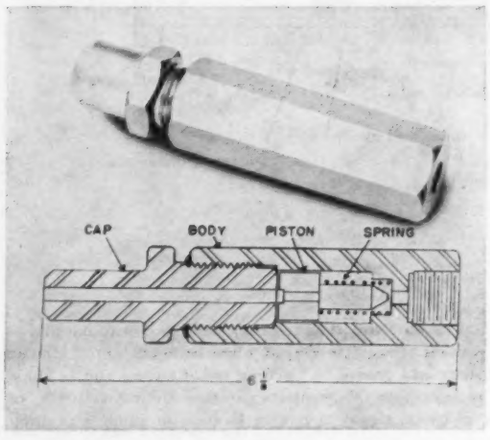
COUPLING CROSS SECTION

Slip coupling and torque limiting are both provided in this coaxial shaft coupler. If the load exceeds the limit torque, the two shafts rotate relative to each other at the full torque limit. The coupling element is a stepped spring operating between the inside of a cylinder fastened to one shaft and the outside of a second cylinder fastened to the second shaft. Rotation of an element in one direction causes coils in contact with the drum to grip tightly and the coils inside the cylinder to contract, producing slip. Rotation in the opposite direction reverses the action of the spring parts. Limit torques can be designed to have the same or different torques for the two directions of rotation. A 10:1 ratio of torque is available in standard units. Torque limits remain the same at breakaway as well as at high-slip velocities throughout the life of the coupling. The standard couplings are designed to operate for 1000 hr continuous slip at maximum power dissipation ratings with life extended for operation below maximum ratings. The couplings are fabricated of corrosion-resistant materials and are designed to meet military specifications.

Machine Components Corp., 39 Fair Lane, Jericho, L. I., N. Y.

Excess-Flow Check Valve 303

Shuts off Leaking Pipes



Hazards caused by the sudden failure of pipe, gage or tubing in a system handling noxious, radioactive, flammable or toxic liquids and gases are minimized with this excess-flow check valve. When system flow exceeds a predetermined rate, a spring-loaded poppet valve closes. When the downstream rupture has been sealed and the system recharged to normal pressure, the valve resets itself and normal flow is restored. The valve has two moving parts and can be supplied to provide either complete closure or a very slow calibrated leak. The valves have been installed between atomic reactors and instrument lines connected to flow meters or other remote instruments.

Chemiquip Co., 36 E. 10th St., New York 3, N. Y.

Low-Profile Hose Clamp 304

For Use in Limited Space

The low-profile, keystone-shaped head of this hose clamp makes it particularly adaptable to applications calling for installation in close quarters. The wide band of the keystone ring distributes clamping pressure over large areas and reduces the tendency of cutting or abrasion on hose surfaces where motion or vibration of hose assemblies is a factor. The clamp is installed with a simple air or hand tool designed to provide takeup in the lug while at the same time compressing the metal into a compact head designed to resist opening. A large range of hose sizes can be accommodated for low- and medium-pressure applications, with the clamp designed to easily slip over the hose OD to be positioned for takeup.

Cuyahoga Products Corp., 1600 N. Woodward, Birmingham, Mich.

NAME YOUR STAINLESS SHAPE!

The design and manufacture of quality stainless steel castings is a specialized job . . . *and Dodge specializes in it!*

There is practically no limit to the variety of shapes we can turn out to meet your simple or intricate specifications precisely . . . economically.

Perhaps one or more DS castings shown here will help spark an idea of how Dodge can be of assistance for *your* stainless steel casting needs. A blueprint or sketch with operational details will bring complete information, without obligation.

DODGE STEEL COMPANY
6501 State Road
Philadelphia 35, Pa.
• *Phone: DEvonshire 2-2200*

DS DODGE PRODUCTS

THE MOST IMPORTANT ALLOY IN A STAINLESS STEEL CASTING IS QUALITY

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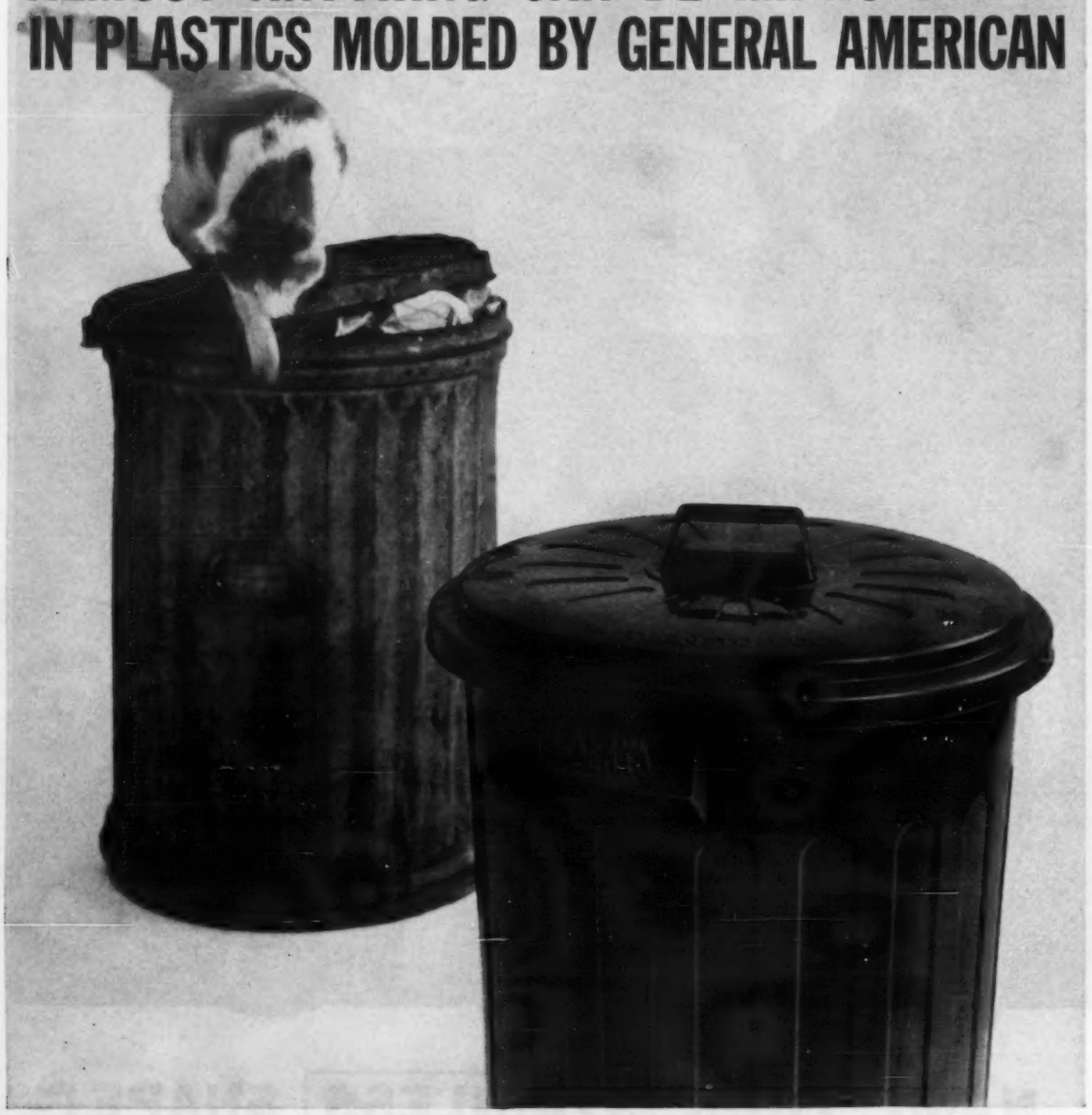
ALMOST ANYTHING CAN BE IMPROVED . . . IN PLASTICS MOLDED BY GENERAL AMERICAN



Sears Roebuck wanted dent-proof, rust-proof, quiet refuse containers. General American helped provide the answer.

The line of containers General American helped develop for Sears varies in size from 20-gallon trash cans to two-quart pails. All are colorful and easy-to-clean; won't rattle or dent.

Resourceful solutions to plastics problems are not at all exceptional at General American. Our engineers and plastics specialists are backed by the largest, most varied molding facilities in the world: compression presses to 2,000 tons . . . injection presses to 300 ounces . . . large extruding and vacuum-forming machines.

If you'd like to move profitably into plastics, you'll certainly find it pays to plan with General American.

PLASTICS DIVISION GENERAL AMERICAN TRADE MARK

Plastics Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South La Salle Street • Chicago 3, Illinois • Offices in principal cities

Circle 34 on Reader-Service Card for more information

Miniature Geared Dial 305

This miniature geared dial measures 3-1/16 inches square but provides a 100:1 vernier ratio to the output shaft. A second knob provides direct 1:1 ratio for rapid shaft positioning. The miniature dial provides rotation from 0 through 360 deg continuous, either clockwise or counterclockwise. Dials are available graduated in 180 divisions on angular scales, 200 divisions on 0-100 scales or 128 divisions on mil scales. Dial graduation accuracy is within 12 minutes of arc. The "Mini-Dial" is

mounted by pushing it over the shaft extended through the panel. A spring-loaded collet holds the shaft and may be tightened as needed. Using two tap holes in the panel and two clearance holes in the dial assembly, the entire unit is fastened to the panel. Suggested uses include tuning capacitors, function generators or as an angular positioner for synchros and resolvers.

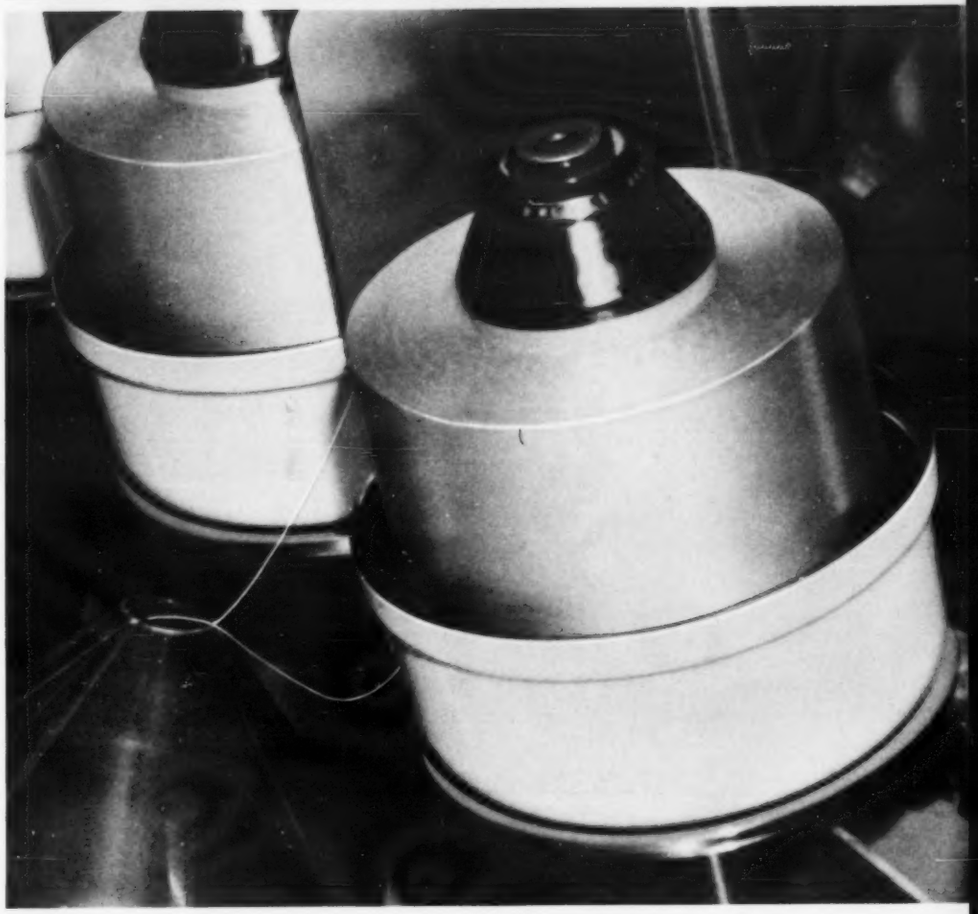
Theta Instrument Corp., 520 Victor St., Saddle Brook, N. J.

Circle 35 on Reader-Service Card

working with

Du Pont Delrin

one of Du Pont's versatile engineering materials



New textile supply buckets of DELRIN® last longer... cost less

Large (10 in. diameter, 1¼ lbs.) buckets economically injection-molded of Du Pont DELRIN acetal resin provide Leesona Corporation, Providence, R. I., with a rugged, long-wearing part for their heavy-duty textile machinery.

Evenly wound packages of filament yarn sit within the buckets of DELRIN (shown above) on a multi-spindle Twister-Coner machine. This machine transfers the yarn from the evenly wound spools to cones at a rate of 340 yards per minute.

The bowl-shaped buckets (molded by Crystal Thermoplastics, Inc., Pawtucket, R. I.) are stationary and thus are subject to abrasion and static build-up by friction of the moving yarn. DELRIN resists both—in fact, outwears phenolic resins previously used—and, in addition, DELRIN maintains its dimensional stability in dry or humid environment.

DU PONT

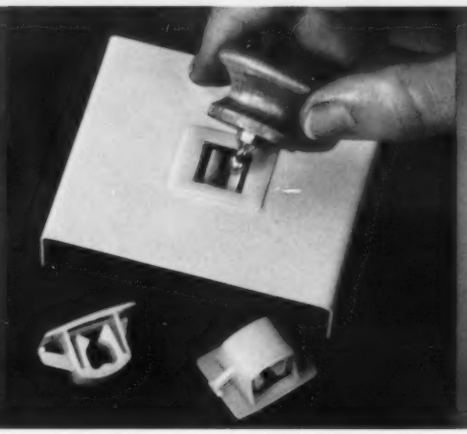
REG U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING THROUGH CHEMISTRY

working with

Du Pont Delrin

one of Du Pont's versatile engineering materials



CAN TAP VALVE for use with packaged refrigerant containers is molded entirely of DELRIN except for piercing needle. Molded-in threads are strong and clean; caps fit tightly. Parts molded of Du Pont DELRIN do not corrode and maintain their dimensions under a wide range of temperatures and humidity. (Molded by Industrial Plastic Molders, Inc., for Watsco, Inc., both of Hialeah, Florida.)

CABINET CATCHES molded of DELRIN take advantage of the resilient, spring-like properties of this resin to permit easy installation of the catch and to hold the steel strike. Abrasion and fatigue resistance of DELRIN allow long life under repeated cyclic stressing of the retaining fingers. Its natural lubricity permits steel strike to move smoothly. (Made by Amerock Corp., Rockford, Ill.)

LAWN SPRINKLERS molded of tough Du Pont DELRIN resist abrasion fro sand and silt. DELRIN offers excellen resistance to corrosion and "lime-up" trouble-free service, excellent threa strength. And a choice of colors is mad possible by the integral colors of DELRI acetal resin. (Molded by Lee Deane Pro ducts, Inc., for Plasmet Engineering Co both of Santa Fe Springs, California.)

DELRIN has strength and toughness

to function reliably under rugged usage. Parts molded of Du Pont DELRIN acetal resin retain a high degree of their mechanical properties under severe environmental conditions, such as high temperatures, moisture, solvents and many corrosive chemicals.

Many designers are taking advantage of the wide range of unique properties of DELRIN, and the substantial cost economies in manufacture and assembly. Why not investigate the possibilities of DELRIN for your product? Mail the coupon below for more information.

POLYCHEMICALS DEPARTMENT

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Department 4 Room 2507-D
Nemours Building, Wilmington 98, Delaware

A B C D

I am interested in evaluating DELRIN for the following use:

_____

*Name*_____

*Company*_____ *Position*_____

*Street*_____

*City*_____ *Zone*____ *State*_____

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DELRIN® *acetal resins*

one of Du Pont's versatile engineering materials

Alathon® · Zytel® · Lucite®

Industrial Nylon Zipper 306

This slide fastener differs from conventional zippers in that the teeth and tape are made of nylon. The fastener is designed for a wide variety of industrial, military and consumer product applications where adverse conditions reduce the effectiveness of metal zippers or render them inoperable. Because of nylon's low coefficient of friction, the "Nylon-Zip" will never stick or require lubrication or other maintenance. The fastener tends to repel foreign substances and can be operated smoothly, even when the chain is covered with dirt, mud or sand. The fastener is not affected greatly by temperature, being able to withstand direct heat up to 360F and cold as low as −70F. Because it will not jam or freeze shut, the fastener is widely used for arctic equipment and apparel. The fasteners are offered in 28 different colors, in all lengths and in both separating and nonseparating types.

Waldes Kohinoor, Inc., Slide Fastener Div., 47-16 Austel Place, Long Island City 1, N.Y.

Circle 35 on Reader-Service Card

Some Ideas

K+E

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.

Frankly, we hope you're a fusspot. If you are fussy about the way you work, and proud of it, we think you'll enjoy knowing about these K&E items . . .

A Real "Clinging Vine"

Some of our more meticulous K&E people have been known to walk out of a drafting room in a cold sweat at the way the drafting boards were covered. Its those ripples, wrinkles and bends that cause all the anxiety. "How," mutters our loyal agent, "can you expect to draw a straight line on a wavy surface?"

And its all so easy if you just take the right K&E product and mount it in the right way. The product in this case is LAMINENE® N70 Board Surface Material. This is a product *unique* with K&E. We hold a patent on the process that *laminates* a thin acetate film to a tough paper base – quite a bit different than simply *coating* a paper with plastic. And the results are different too.

It's rather a dramatic show of force that LAMINENE stages on a board. The secret is in the irresistible urge of a natural product to return to its normal state. In this case, when you *wet* the back of LAMINENE you expand it ever so slightly. When tacked or taped under the edges of the board, it begins to dry and shrink. The paper backing builds tension on the surface as it dries, finally reaching a smooth taut state . . . with enough tension left over to keep it permanently wrinkle-free. No matter what the temperature or humidity, LAMINENE stays with the board as if cemented there.

Add to this a fine, springy quality, and a variety of other features – grid lines, green color, washability – and you can see why LAMINENE rates at the top in popularity for a semi-permanent board covering.

Would you like a sample? It's yours for the asking. See your K&E dealer or return the coupon at the right.

Time Saving Stickers

Want to eliminate a time-consuming chore? You can cut down on tedious repetitive lettering by having title blocks, specifications, and other symbols or legends printed – clearly and sharply – on DULSEAL™ (74). This tissue-thin film has a delayed-action adhesive on the back, and a dull-finish face for easy writing or printing.

Stickers made of DULSEAL can be firmly positioned—and re-positioned hours later, just as firmly. The adhesive takes 24 hours to set. Once it does set, a permanent bond is formed with the paper or cloth beneath. DULSEAL is chemically stable, and the adhesive will not bleed, even in hot copying machines.

Repeated erasures on DULSEAL will not affect its "take." Produced by an exclusive process, the "tooth" is *built into* the surface. Transparent and low in reflectivity, DULSEAL stickers will not affect the transparency or printing speed of your drafting medium. K&E supplies DULSEAL in sheets, rolls (printed to your specifications if you wish), and as a mending tape in a handy dispenser. Try a sample, on us!

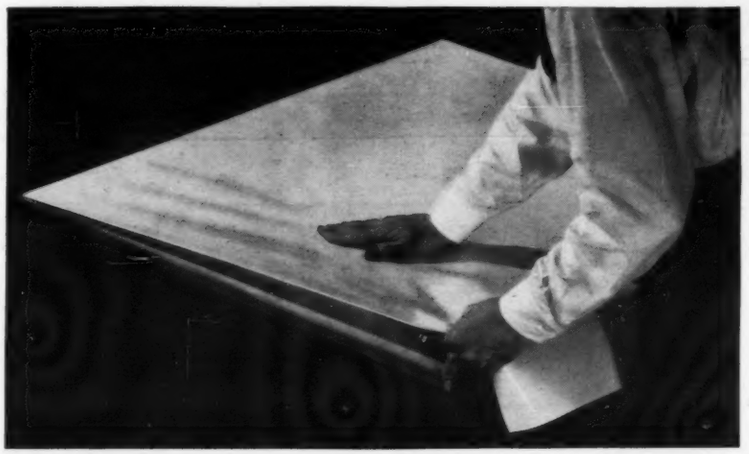
3 To Keep Clean

Best way to keep your tracings clean: don't let them get dirty. A mighty easy way to achieve this is to sprinkle the tracing lightly with gum eraser particles, while working. Then, triangles, T-squares, and scales stay clean, and clean the surface *automatically*, as they are moved back and forth. The particles will not dry out or harden – they contain no grit or abrasives. They'll actually improve the ink taking qualities of your drafting surface.

For this purpose, K&E supplies cleaning particles put up in three different ways. We think the new plastic squeeze-bottle (3036C) is the handiest of all. The shaker-top can (3036) has also been a drafting-room favorite for some time. And, for double-duty cleaning, we suggest the ABC DRY-CLEAN PAD™ (3037) or DRY-CLEAN JR.™ (3037J)—a smaller version—which hold slightly coarser granules that sift through soft mesh. The ABC Pad also comes in handy for wiping a complete tracing after it is finished, or for preparing certain surfaces for ink work. Or for an overall pre-cleaning, since the best way to insure clean tracings is never to let soil build up.

The proverbial ounce of prevention is worth the traditional pound of cure!

These K&E products, and others that can make life easier for you, are available from your nearby K&E dealer. See him soon . . . or send us the coupon below for further information and samples.



KEUFFEL & ESSER CO., Dept. DN-12 Hoboken, N. J.

Please send me samples and information on LAMINENE® Drawing Board Surface Material, and DULSEAL™ Tape . . . plus information on K&E cleaning powders.

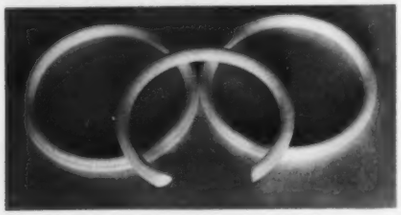
Name & Title_____

Company & Address_____

4250-B

Circle 36 on Reader-Service Card for more information

Slotted 'Teflon' O-Rings 307



Slotted O-rings made of "Teflon" provide a solution to difficulties encountered with solid O-rings. The rings are said to be easier to install and to provide improved sealing action. Designed to fit standard AN grooves, the slotted rings can replace rubber O-rings without altering groove size. Use of "Teflon" makes the seal ideal for use against nonflammable hydraulic fluids, solvents and acids.

Garlock, Inc., Palmyra, N.Y.

Differential Indicator 308

Model 110 differential pressure indicators are obtainable in ranges from 20 to 400 psid at working pressures up to 1000 psi. The indicator has been developed to cover the wide range of industrial processes having working pressures up to 750 psi and therefore not requiring the higher case strength of the 4000 Series instruments. The indicators are used in industrial process systems including flow-rate measurement, measurement of pressure drops across filters or indication of comparative fluid levels in different parts of a system.

Mid-West Instrument, Div. of Astra Associates, Inc., 1021 E. State Fair, Detroit 3, Mich.

From Monsanto FluiDesign Service...

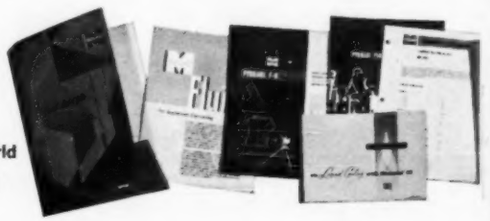
FLUIDS TO HELP TAME FIRE HAZARDS

Fire-safe hydraulic lifts, loaders, and launchers!

A hydraulic oil leak sprayed from an underground service elevator can ignite on contact with a welding torch, an arcing circuit breaker, even a broken light bulb. Chance ignition of a flammable fluid in a missile launcher, mobile lift, or weapon loader could cause disaster, destroying both missile and base. Monsanto can supply a whole series of fire-resistant *all-synthetic* hydraulic fluids that operate reliably over a wide temperature range. They will not corrode metals; will not clog pumps or valves; will resist change in composition or physical properties even after *years* of storage and service. For maximum fire protection of below-ground military installations, put Monsanto fluids specialists to work—checking out ignition dangers with *your* "hard" base hydraulic equipment designs.

MONSANTO FLUIDESIGN SERVICE OFFERS YOU:

1. **Sophisticated application experience with fluids**
2. **Years-ahead research on new types of fluids**
3. **Time-saving facilities for testing new uses**
4. **More *job-proven* functional fluids than any other manufacturer in the world**
5. **Design-oriented *know-how* to help you develop more compact, safer, and more reliable equipment**



TYPICAL PROPERTIES OF A FEW MONSANTO FLUIDS	OPERATING TEMPERATURE RANGE (°F)	VISCOSITY (centistokes @ °F)	POUR POINT (°F)	MAXIMUM LONG TERM BULK TEMPERATURE (°F)	SPECIFIC GRAVITY 25°/25°C
SKYDROL® 7000	−40 to 200	15.5 @ 100 4.00 @ 210	<−70	200	1.08
SKYDROL 500A	−65 to 225	2300 @ −65 11.5 @ 100 3.92 @ 210	<−85	225	1.07
PYDRAUL® 60	−25 to 200	10.0 @ 100 2.45 @ 210	−70	200	1.09
PYDRAUL 150	−15 to 200	30.8 @ 100 8.0 @ 210	−55	200	1.13
PYDRAUL F-9	+50 to 300	47 @ 100 5.5 @ 210	0	300	1.28
PYDRAUL A-200	+50 to 300	31 @ 100 2.86 @ 210	+10	300	1.42
PYDRAUL AC	+60 to 300	88.2 @ 100 5.15 @ 210	+20	300	1.35
OS-81	+50 to 300	34.0 @ 100 3.1 @ 210	+20	300	1.40

THESE DIELECTRICS AND FIRE-RESISTANT FLUIDS

AT "HARD" BASES

Fire-safe electrical generation and distribution!

If you are designing, installing, or operating electrical power systems for below-ground service, let Monsanto guide you to greater fire safety for these vital installations. Oil *under ground*, in bulk storage or in service, can be hazardous—far more critical than above ground. Monsanto fluids assure greater safety—with *fire-resistant turbine lubricants*, *fire-resistant dielectric fluids* for *high confidence level* transformers in substation distribution points.

Transformers filled with Monsanto fire-resistant askarels have been used for years by major utility companies to assure safe, reliable performance of their equipment. Build maximum fire safety into your ground support equipment with Monsanto fluids that eliminate fire hazards.

BE SURE TO GET YOUR FACT-PACKED FLUIDESIGN FILE. WRITE ON YOUR LETTERHEAD TO:

Monsanto

Monsanto Chemical Company
Organic Chemicals Division
FluiDesign Service, Dept. 4454J
St. Louis 66, Missouri

	BULK MODULUS psi @ 77°F	SURFACE TENSION (dynes/cm)	COEFFICIENT OF THERMAL EXPANSION	HARDWARE COMMERCIALLY AVAILABLE FOR FLUID USE	FLUID STATUS	FIRE RESISTANT
	328,000	**28.9**	**0.00042**	**YES**	**Commercially Available**	**YES**
	308,000	**30.8**	**0.00045**	**YES**	"	**YES**
	328,000	—	**0.0004**	**YES**	"	**YES**
	319,000	—	**0.00042**	**YES**	"	**YES**
	387,000	—	**0.00041**	**YES**	"	**YES**
	400,000	—	**0.0004**	**YES**	"	**YES**
	375,000	—	**0.0004**	**YES**	"	**YES**
	—	—	—	**YES**	**Development Product**	**YES**

ASSURE RELIABILITY AND SAFETY

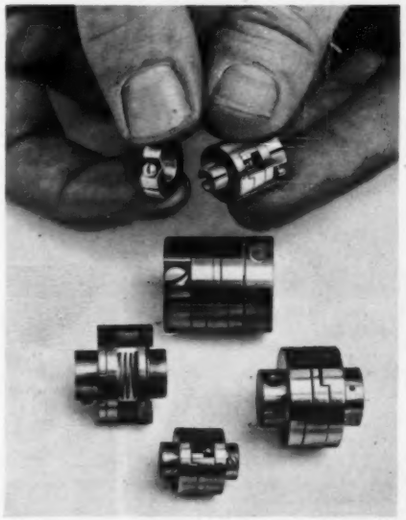
Circle 37 on Reader-Service Card for more information

Component Hangers 309

These precision hangers serve as shaft supports and component mountings in the assembly of breadboard mechanical or servo devices. A wide range of sizes is available to fit standard rotating computer components. Material is rigid aluminum-alloy casting, machined for squareness, and black anodized.

Sterling Instrument Div. of Designatronics, Inc., 17 Matinecock Ave., Port Washington, N.Y.

Precision Shaft Couplings 310



More than 60 different combinations of clamp and solid-type hubs are available to couple different shaft sizes, ranging from 0.125 to 0.250 inch in dia. The couplings permit as much as 1/32-inch misalignment and feature a backlash tolerance of 8 minutes of arc. The couplings are made of stainless steel and are used largely in breadboarding projects.

Dynamic Gear Co., Inc., Amityville, N.Y.

General Electric Makes Eddy-current-coupling Drives

And they're dependable drives. The complete line includes water-cooled and air-cooled eddy-current couplings. We call them KINATROL* drives. Ratings are from 1 to 150 horsepower, operating from standard a-c power.

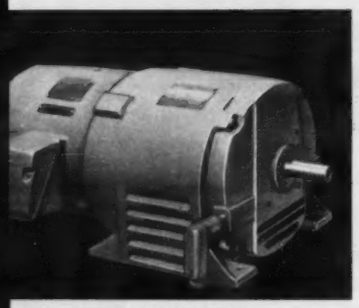
A General Electric KINATROL drive is not just another eddy-current coupling. For instance, in the water-cooled coupling, water control is packaged. You'll see much less external piping. Furthermore, the coupling is protected from flooding—and the air gaps are dry, preventing corrosion.

KINATROL couplings are compact, field proven and dependable. General Electric has had a good deal of experience in the engineering, manufacturing, and application of packaged adjustable-speed drives. And we know how important service is to a customer.

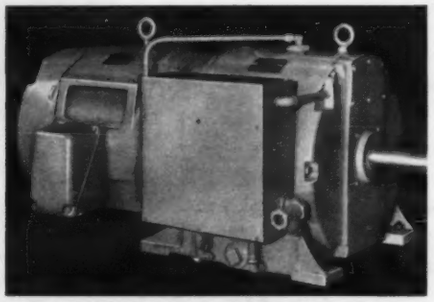
KINATROL —a good product, with the kind of service you can depend on. Please call your nearest General Electric Sales Office for further details.

*Trademark of General Electric Company

821-07



AIR COOLED, 7-1/2 to 100 HP



WATER COOLED, 25 to 150 HP

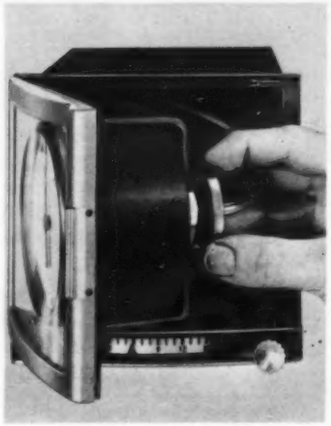
AIR COOLED, 1 to 5 HP

DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT

GENERAL ELECTRIC

ERIE, PENNSYLVANIA

Indicator Pointer Reads 12 O'Clock 311

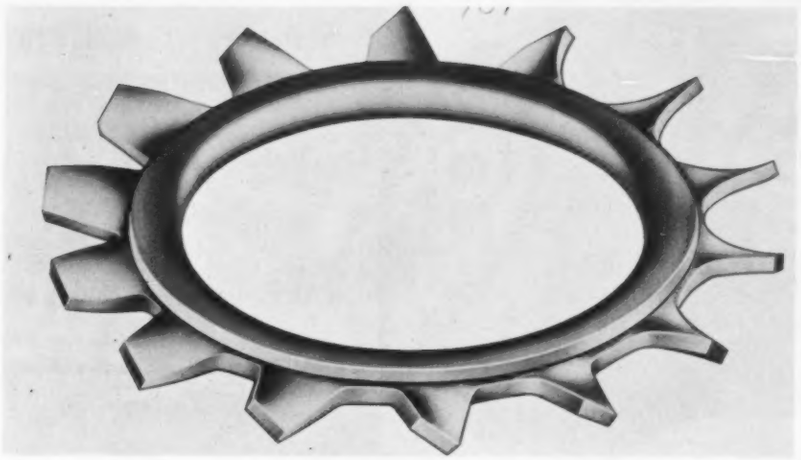


Installations having a large number of dial indicators are easier to monitor if the normal dial pointer is the same in each case. The Series 1214 miniature indicating control station permits vertical positioning of set points, regardless of the actual set-point value. In this way, an operator can easily scan a large number of instruments whose pointers all should be at 12 o'clock. To use the scanning feature, the set point is first established by turning the indicator to the proper point on the dial. The set-point indicator, process indicator and dial then are positioned simultaneously at 12 o'clock by turning an adjustment knob behind the gage. Dial numerals are printed so that only the one at 12 o'clock is in an upright position. Any deviation of the indicator dial is readily noticed. The units operate from a standard 3- to 15-psig input to a Bourdon tube or "Ni-Span C" diaphragm-type actuating element. The instruments are housed in fully enclosed steel cases measuring 6 by 6 by 12 inches, suitable for mounting in exposed locations.

Fischer & Porter Co., 3 Jacksonville Rd., Warminster, Pa.

Circle 38 on Reader-Service Card

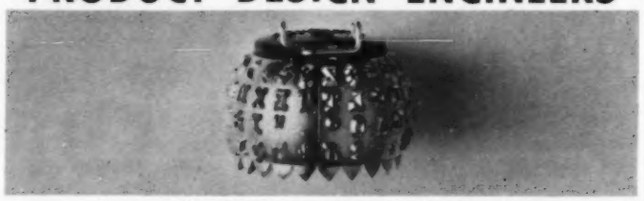
Folded-Rim Lock Washers **312**



Folded-rim lock washers are a modification of the standard external lock washer with a folded internal rim providing additional body strength to resist extreme fastening stresses when working with steel, die-casting or other metals requiring high torques. The washer is particularly useful in applications involving high-pressure sealing, since the folded-rim feature eliminates thread leakage. Folded-rim lock washers now are available in sizes ranging from a No. 10 to 5/8 inch.

Shakeproof Div. of Illinois Tool Works, Inc., St. Charles Rd., Elgin, Ill.

PRODUCT DESIGN ENGINEERS



Electric Typewriter Division

New developments in key projects have created several excellent career opportunities for experienced Product Design Engineers.

Qualifications: experience in design and layout of complex, high-speed mechanical and electro-mechanical devices and knowledge of production design requirements. Responsibilities will include performance of design and layout, as well as completion of detail and assembly drawings.

Excellent company benefits and working facilities. Relocation expenses paid.

All qualified applicants will receive consideration without regard to race, creed, color, or national origin.

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Dept. 544L4
IBM Corporation
Lexington, Kentucky

IBM

INTERNATIONAL BUSINESS MACHINES CORPORATION

Please furnish home address.

Circle 546 on Reader-Service Card

STOP SHOCK AND VIBRATION FAILURES!

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Division of Barry Wright Corporation — BW

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ANALYSIS • ENGINEERING • MANUFACTURING

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Right to a thousandth when you adjust with LAMINUM®

Just *p-e-e-l* the laminations—it's that easy to get accurate assemblies with LAMINUM . . . even as close as a thousandth. No machining. No grinding. No counting. No stacking. No milking. And no need for stand-by equipment.

LAMINUM is versatile, too. You have a choice of brass, mild steel, stainless or aluminum . . . of .002″ or .003″ laminations . . . of plastic bond or metallic bond. **And now also in Titanium with laminations of .003″!**

Whatever your choice, we'll custom-stamp LAMINUM to your own rigid specifications . . . any size, any shape, and quantity . . . to look and act like solid metal . . . to help you produce more and better assemblies . . . in less time . . . and at less cost.

That's what makes LAMINUM so practical. So popular. So easy to use. Revised SHIM DESIGN FOLDER No. 5 gives complete up-to-the-minute engineering data. Send for your copy today.

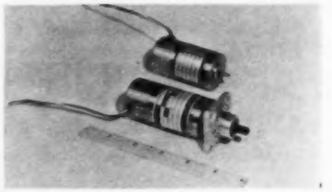
THE LAMINATED SHIM COMPANY, INC.
Home Office and Plant
1112 Union St., Glenbrook, Conn.

'Teflon'-Coated Seals 313

A production process which coats only the outer seal wall with an even dispersion of "Teflon" reduces the breakout and running friction while increasing the life and durability of these seals. The design reduces the coefficient of friction to a value between 0.05 and 0.07. The "Teflon"-coated, flexible, molded seals are available as O-rings, V-rings and U-cups.

Seals East Orange, Inc., 393 Central Ave., East Orange, N.J.

1-3/8-Inch Wound Field Motor 314



Although measuring only 1-3/8 inches in dia, these motors feature a wound field. Type GJA is 3 inches long and is rated at 1/50 hp at 10,000 rpm. Type GJY is 2-1/2 inches long, rated 1/100 hp at 10,000 rpm. Both motors normally are furnished with a split series field for three-wire reversibility, but can be furnished as split series, shunt or split shunt. Options include an integral brake or a governor and a planetary gear reducer with a choice of 101 standard gear ratios. Maximum motor weight is 7.2 oz.

Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio.

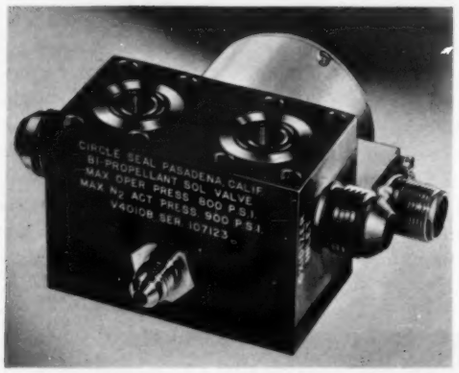
Circle 40 on Reader-Service Card

Computer-Drive Motor 315

Designed for use where operation is almost entirely under a stalled condition, this high-reliability motor is rated at 500 oz-in torque at 0 rpm. The Model 4026-4 operates on a 50v input voltage at a no-load speed of 1500 rpm. Length of the motor is 8 inches, dia is 4 inches and the unit is equipped with a special shaft, brake and flange mounting to meet exacting computer specifications.

Eicor Div., Indiana General Corp., 517 W. Walnut St., Oglesby, Ill.

Quick-Acting Control Valve 316



Response times of less than 5 millisec from electrical signal to full open or full close have been proved for this bipropellant control valve. The unit is said to be capable of 100 cps without valve float. System pressure holds the flow-control poppets closed until actuated by a solenoid. Pilot valves then dump the gas holding the poppets closed and allow pressure in the fuel and oxidizer systems to open their respective valves. Actuation of fuel and oxidizer poppets is accomplished in less than 1 millisec or simultaneously within 1/2 millisec, allowing balanced flow of both fuel and oxidizer. De-energizing of solenoids closes pilot valves, causing the poppets to be pressurized by the control pressure, closing fuel and oxidizer poppets within 1/2 millisec. System pressure then holds the valve in an "off" position. The high-response, bipropellant valve has a burst pressure of over 1600 psi with simultaneous pressurization at all external ports. Weight is less than 2 lb. The valve is designed for directional control or maneuvering of rockets or space vehicles and will operate under acceleration and vibration conditions encountered in this service.

James, Pond & Clark, Inc., 2181 E. Foothill Blvd., Pasadena, Calif.

DIE SETS!

YOU NAME IT...WE GOT IT!

Plain and Ball Bearing Die Sets in both Precision and Commercial Grades, in Steel, Semi-Steel and Steel, and in Semi-Steel.

- **12** Different Die Sets
- **5** Different Styles
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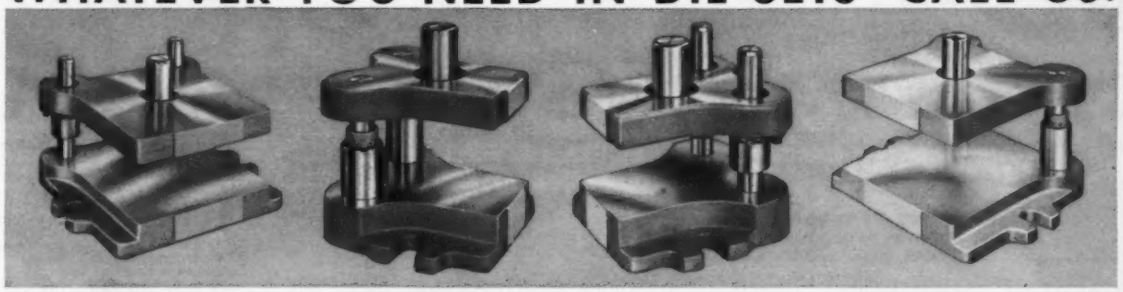
Also, a complete line of STEEL RULE DIE SETS and COMPONENTS.

WHATEVER YOU NEED IN DIE SETS—CALL US!



LEMPCO INDUSTRIAL, INC. DIE SUPPLY DIVISION

Main Offices: 5490 Dunham Road • Bedford, Ohio • Telephone: GReenwood 5-2400 • Teletype: Mtrs O. 123

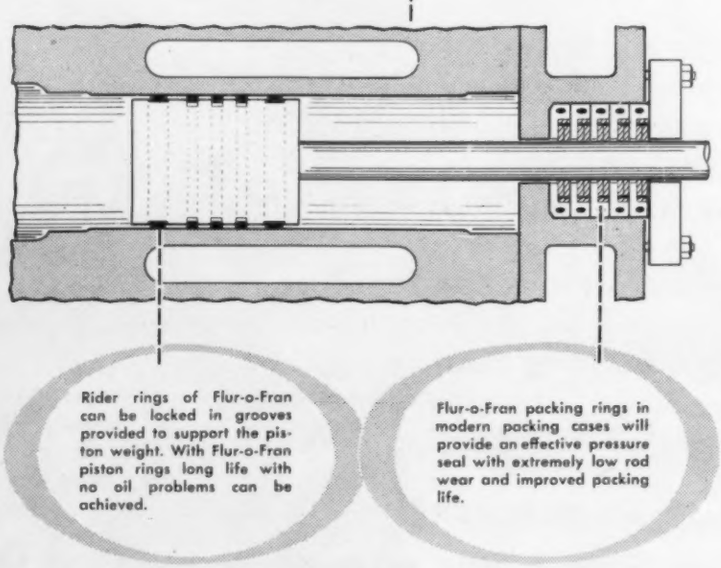
Parent Corporation: LEMPCO PRODUCTS, INC. • *Subsidiaries and Affiliates:* LEMPCO INDUSTRIAL, INC. LEMPCO AUTOMOTIVE, INC. • LEMPCO INTERNATIONAL, INC. • EVANS REAMER & MACHINE CO.

Quality • Dependability • Service • Since 1918

Circle 41 on Reader-Service Card for more information

YOU CAN ADAPT FLUR-O-FRAN* TO YOUR *present* COMPRESSORS

conversion of many compressors to non-lube service is being accomplished successfully by the use of filled **TEFLON**† *rings and packings.*



Rider rings of Flur-o-Fran can be locked in grooves provided to support the piston weight. With Flur-o-Fran piston rings long life with no oil problems can be achieved.

Flur-o-Fran packing rings in modern packing cases will provide an effective pressure seal with extremely low rod wear and improved packing life.

Compressor builders are right when they tell you there is more to satisfactory conversion of your compressors than simply changing rings. You take advantage of our combined years of experience when you convert with FLUR-O-FRAN. Our engineering and field service, products and production facilities are unsurpassed.

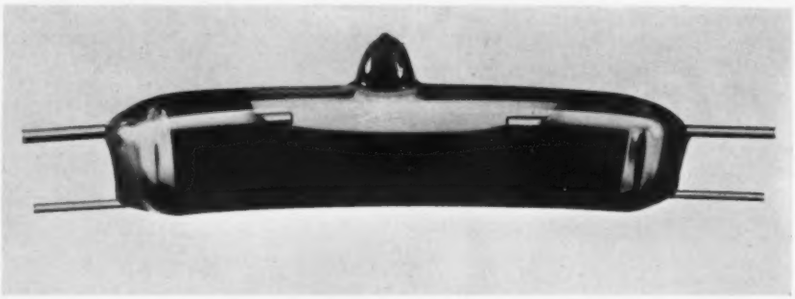
* Trade Mark . . . FLUR-O-FRAN, a special compound of TEFLON and other materials, having unique properties — highly resistant to chemical attack — wide temperature range, —350°F to +500°F — extremely low coefficient of friction.

† Registered Trade Mark for du Pont FLUOROCARBON Resins

FRANCE PACKING COMPANY
9925 BUSTLETON AVENUE
PHILADELPHIA 15, PA.

Circle 42 on Reader-Service Card for more information

Gravity-Sensing Electrolytic Potentiometer 317



Although resembling a mercury switch, this device actually is a potentiometer. The instrument is a curved glass tube containing a predetermined amount of electrolytic solution to create an air bubble. Tilting moves the air bubble and causes a variation of impedance by changing the degree of immersion of the top electrodes. When balanced or in a horizontal position, the impedance between the top electrodes and a common electrode at the bottom is equal. When tilted, the bubble moves off center, increasing the impedance of one electrode, decreasing the impedance of the other, to the common electrode. The viscosity and surface tension of the electrolytic fluid eliminate the erratic action associated with a mercury switch. The proportional output obtained as a horizontal position is approached enables close control in a servo system and keeps "hunting" to a minimum.

Hamlin, Inc., Lake Mills, Wis.

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VERNITRON .05% ACCURACY PRECISION RESOLVERS DELIVERED ON REGULAR PRODUCTION BASIS

60 THROUGH 10,000 CYCLE

ALL SIZES—8 through 23
ALL STANDARD TYPES—Computing, Data Transmission, Phase Shifters and Sweep
ALL ENGINEERED & MANUFACTURED TO: MIL-R-14346
ALL AVAILABLE WITH
- Thru-Bore Design
- High Reliability *Exclusive* Brush Block
- Stainless Steel housings, shaft, bearings
- High voltage capabilities between stator and compensator windings (on feedback units)

A major break-through, made possible by VERNITRON specialization in precision synchro and resolver design and manufacture.

WRITE, WIRE, PHONE NOW for complete price, delivery and specification data; ask for NEW Vernitron Condensed catalog.

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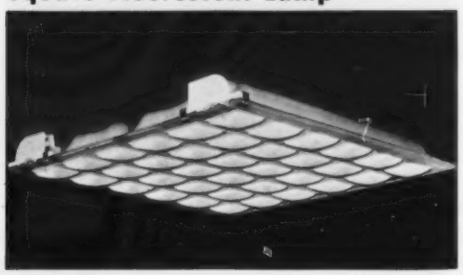
Circle 43 on Reader-Service Card for more information

Square Fluorescent Lamp

318



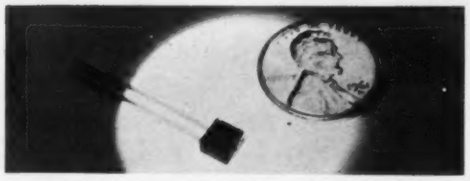
Fluorescent lamps now are manufactured in squares measuring 12 inches on a side and 1-1/2 inches deep. The new style provides the same light as conventional tubular fluorescent lamps with high efficiency (60 lumens per watt) and long life. The compact square lamp is expected to extend the range of design in lighting systems and luminaires.

General Electric Co., Lamp Div., Nela Park, Cleveland 12, Ohio.

Subminiature Toroidal Inductors

319

Measuring 0.2 by 0.2 by 0.1 inch, these subminiature toroidal coils range in value from 0.01 to 33 microhenries. The extremely small units have a volume of 0.004 cu in, are vacuum-encapsulated in epoxy and meet specification MIL-C-15305B, Grade 1, Class B (—55 to 125C). Using single-ended or plug-in construction for printed-circuit and module applications, these ruggedly built toroidal inductors are resistant to immersion, moisture and shock. Two ranges are available in Series 91 and 92. The Series 91 units have a frequency range from 25 to 150 mc, inductance values from 0.01 to 1.0 microhenry and a Q of 100 at 60 mc. Series 92 units have a frequency range



from 1 to 50 mc with inductance values from 0.1 to 33 microhenries and an average Q from 70 to 80. The subminiature units have a low external magnetic field and a dielectric withstanding voltage of 700v rms.

Vanguard Electronics Co., 3384 Motor Ave., Los Angeles 34, Calif.

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AT TEMPERATURES FROM —400° F TO +1500° F!

ANY FLUID—GAS—FUELS—WATER—LIQUID METALS—CRYOGENIC FLUIDS—CORROSIVE FLUIDS
ANY SYSTEM—HYDRAULIC—PNEUMATIC—VACUUM—CRYOGENIC—NUCLEAR

NO CATASTROPHIC FAILURES
INFINITE STORAGE LIFE
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Eliminates critical downtime ■ Very high and very low pressure ■ Easy, foolproof installation (not a mechanism) ■ All-metal—non-contaminating ■ Stable, symmetrical design

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TWX 1403U, Phone AN 9-0181

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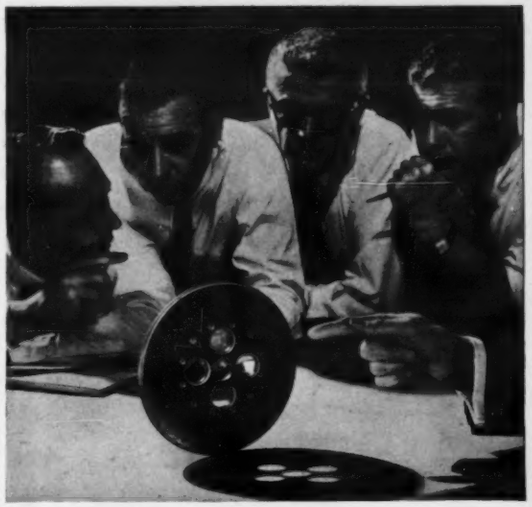
EXPERT Help in Laminated Plastics From Specialists



An Example of
Synthane *You-shaped* Versatility

Do you have a materials problem? Perhaps laminated plastics is the answer: Why not discuss it with our field representative in your territory? He has behind him the entire Synthane organization with over 32 years of experience in the manufacture and fabrication of laminated plastics. Our engineers, technicians and field representatives are specialists in this field, and over two-thirds of our people have over 10 years' experience with Synthane. The solution to your materials problem can probably be found at Synthane.

You-shaped Versatility makes Synthane a Better Buy in Laminates

SYNTHANE
CORPORATION OAKS, PENNA.

Synthane Corporation, 6 River Rd., Oaks, Pa.
Gentlemen:
Please send me information relating to Synthane as a source for laminated plastics materials and parts.

Name_____

Address_____

City_____ Zone____ State_____

Circle 45 on Reader-Service Card for more information

Surface-Sensing Thermostat 320

Built in a rugged brass forging, the Model 279 thermostat is designed to mount with a single bolt on any flat surface. The disc thermal-sensing element is in intimate contact with the mounting surface so that optimum heat transfer and rapid heat-sensing between the equipment and the thermostat is assured. The unit is suited

as a safety temperature alarm on liquid- or air-cooled engines, molds or bearings. The device may be supplied with contacts either normally open or closed and is highly resistant to vibration. Temperature settings as high as 400F may be supplied.

George Ulanet Co., 413 Market St., Newark 5, N.J.

Select from *four*, big, basic families . . .

VT2	VT4	TV8	VT20
1.5-1.8 amp	3.5-4.75 amp	7.5-10 amp	20 amp

● Get *immediate delivery* from your distributor or the factory on 39 stock sizes and types: single transformers, tandems, with and without over-voltage, low voltage, single-phase, three-phase, cased, fixed mounting, portable, 120V and 240V.

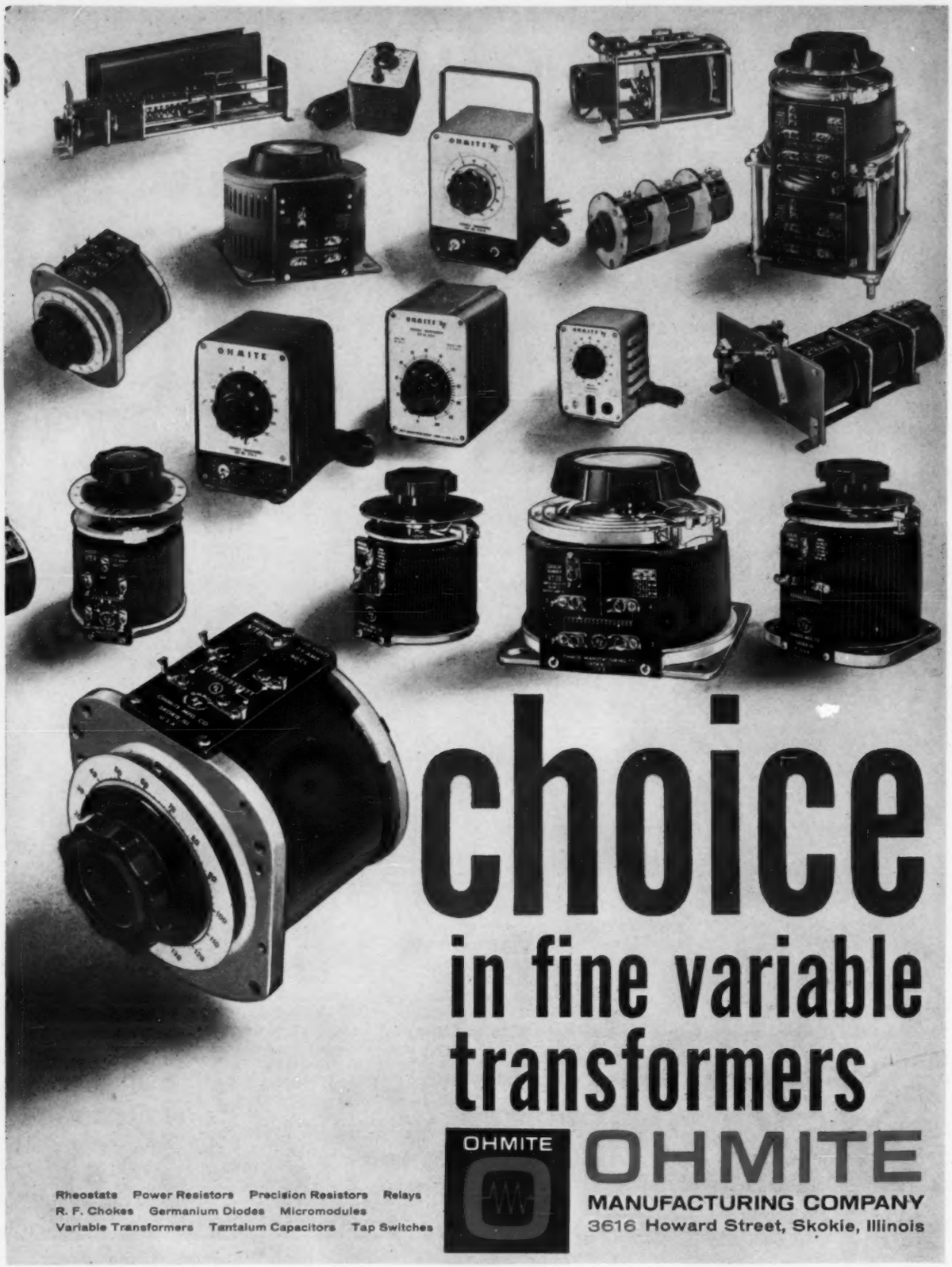
● Choose from *many* special features: tandems, multi-taps, motor drives, concentric controls, special windings, shafts of all types, and job-matched enclosures among others.

● Specify from innumerable possibilities in "custom-engineered" combinations with unusual reciprocating motor drives, complex double-track arrangements, rheostats, toggle switches, and precision switches.

● Pick 36V transformers in 5-, 12-, or 22-amp ratings for your transistorized circuits.

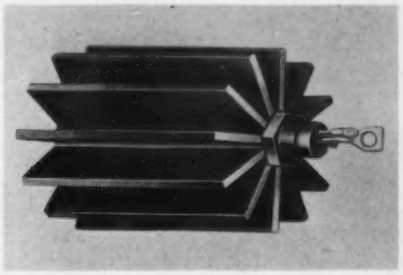
the big

From every aspect, you'll find that Ohmite is a good place to purchase variable transformers. If you need a "special" . . . okay, just tell Ohmite. Need some engineering assistance? All right! What about quantity? Ohmite can handle big orders, medium, and small. The Ohmite VT line of variable transformers is broad and deep. So is the service. Find out by specifying "Ohmite" on your next requirement for variable transformers.



Circle 46 on Reader-Service Card for more information

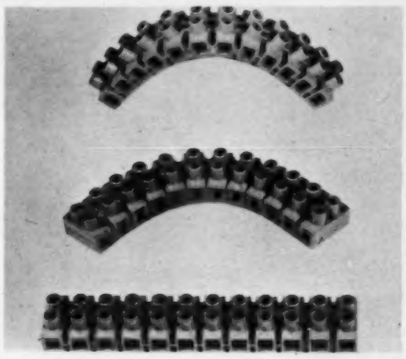
Transistor Heat Sink 321



Designed for stud-mounted semiconductors, these heat radiators are offered in lengths to 6 inches. The radiators are made of aluminum with a dull black anodized finish and meet military specifications. The HS 8040 heat dissipator can be supplied with a choice of finish, mounting hole size or length from 1 to 6 inches with other lengths available.

Vemaline Products Co., Franklin Lakes, N.J.

Solderless Flexible Terminal Blocks 322



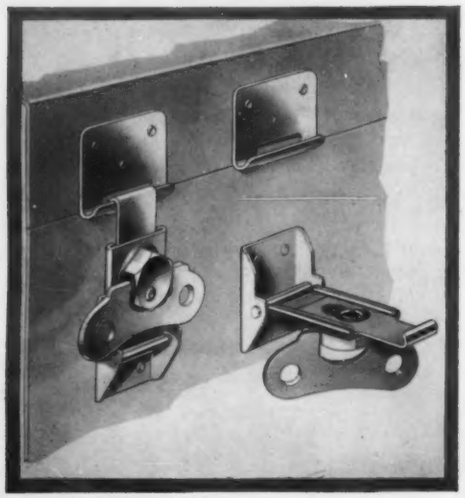
Made of flexible polyester material, these terminal blocks may be bent in any direction to fit contours and sharp angles. The shortest distance between live parts is 3/8 inch. Maximum wire size which the terminals will accommodate is No. 10. The terminal block measures 3-3/4 inches long by 5/8 inch wide by 1/2 inch high, with 11/32 inch between terminal centers. The block may be cut to smaller sizes if required. The No. 905 terminal block is rated to 25 amps and is used in missile-guidance systems, computers, aircraft communication and underwater detecting equipment.

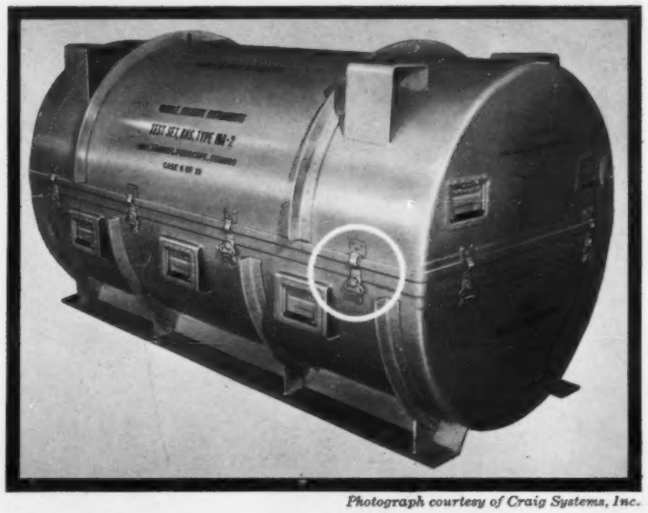
National Tel-Tronics Corp., 52 St. Casimir Ave., Yonkers, N.Y.

Note—Commercial and Military Packaging Engineers:

Rugged LINK-LOCK

...your best answer to exacting closure problems





Photograph courtesy of Craig Systems, Inc.

Simmons LINK-LOCK provides quick opening and closing as well as impact-resistant dependability on transit cases manufactured by Craig Systems, Inc., Lawrence, Mass.

LINK-LOCK provides pressure-tight closure on this rigidly specified equipment container

The cylindrical Craig container above is gasketed and pressure-tight, and contains delicate electronic equipment. Twelve LINK-LOCK fasteners are used on this model.

Here's why LINK-LOCK is ideal for use on military cases produced to exacting specifications as well as on inexpensive commercial containers:

- Impact and shock resistant (positive-locking).
- High closing pressure with light operating torque..... insures pressure-tight seals where required.
- Available in 3 sizes, for heavy, medium, and light duty.
- Compact design...lies flat against case even when unlocked.
- Opening and closing by wing-nut, screwhead, or hex nut.
- Flexible engagement latch design...can be varied to suit different conditions.

Also available: Spring-Loaded LINK-LOCK. Ideal for the less expensive containers where costs won't permit precision production. Spring provides take-up to compensate for set in gasketing, irregularities of sealing surfaces, and mounting inaccuracies.

Where does the versatile Simmons LINK-LOCK belong in your design? For complete information and specifications, send for the Simmons Catalog today. Samples and engineering service available upon request.

SIMMONS
FASTENER CORPORATION
1762 North Broadway, Albany 1, New York
QUICK-LOCK • SPRING-LOCK • ROTO-LOCK
LINK-LOCK • DUAL LOCK

Circle 47 on Reader-Service Card for more information

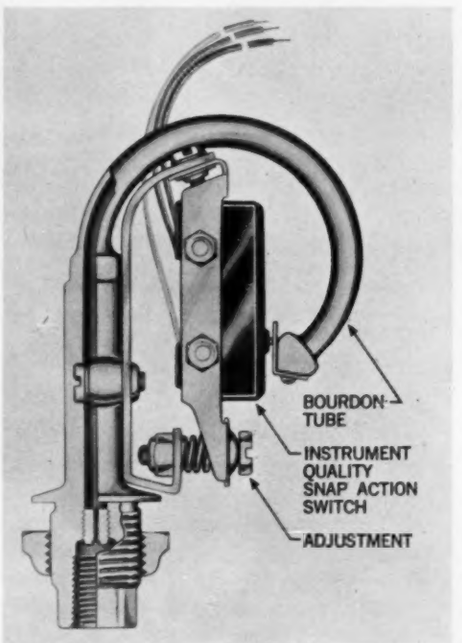
ELECTRICAL

Condenser Microphone Transducers 323

Designed to meet the ASA specifications for a Type L microphone, these units offer wide smooth frequency response, stability, miniature size, small equivalent volume, high sensitivity and individual calibrations. The Model 404 transducers were developed for accurate measurements of sound levels to 160 db. Two sizes are available—0.936 and 0.500 inch in dia—with optional flush diaphragm construction. The microphones may be used with conventional condenser microphone preamplifiers.

Photocon Research Products, 421 N. Altadena Dr., Pasadena, Calif.

Bourdon Tube Pressure Switch 324

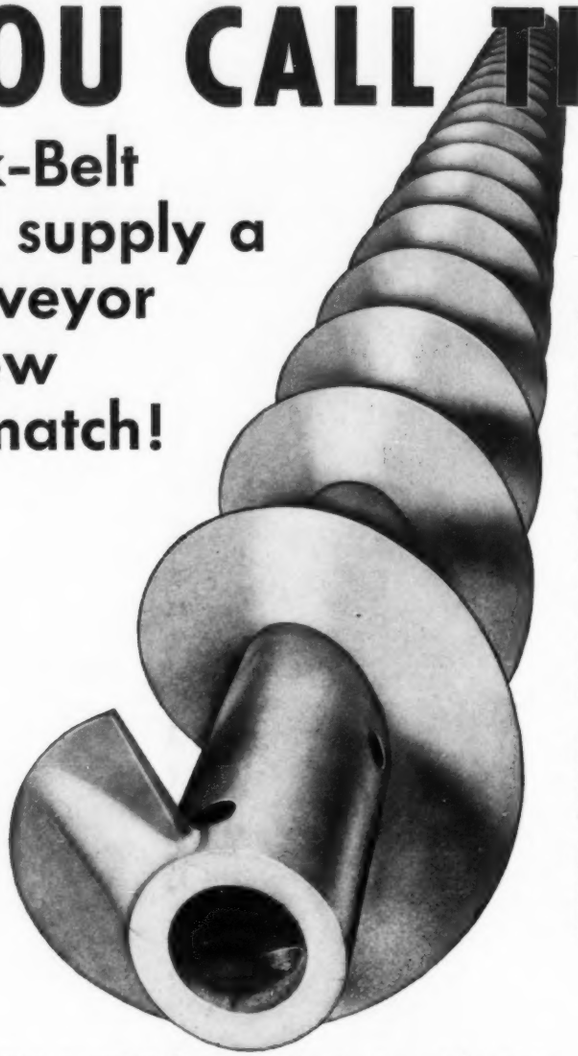


Five classes provide a choice of settings from 50 to 12,000 psi for these bourdon tube pressure switches. Single-setting and dual-control basic switches are supplied with standard housings or explosionproof housings to suit specification requirements. The housings are equipped with integral terminal blocks for wiring convenience and economy, and the explosionproof housings have builtin potting wells. The switch housings have overtravel stops which extend proof pressures to limits of 1800 to 18,000 psi.

Barksdale Valves, 5125 Alcoa Ave., Los Angeles 58, Calif.

YOU CALL THE TURN

Link-Belt will supply a conveyor screw to match!



Just state your screw conveying problem. Link-Belt will come up with a quick, *exact* answer . . . whether your application involves feeding, mixing, blending, spreading, conveying or elevating . . . whether your material is light or heavy, fine or coarse, hot or cold, wet or dry, granular or flaky, sluggish or free-flowing.

Link-Belt offers screw designs in mild steel, stainless, monel, and high-carbon steel or other metals to meet temperature, corrosion, sanitation, abrasion and other requirements—in a full range of diameters, gauges and pitches.

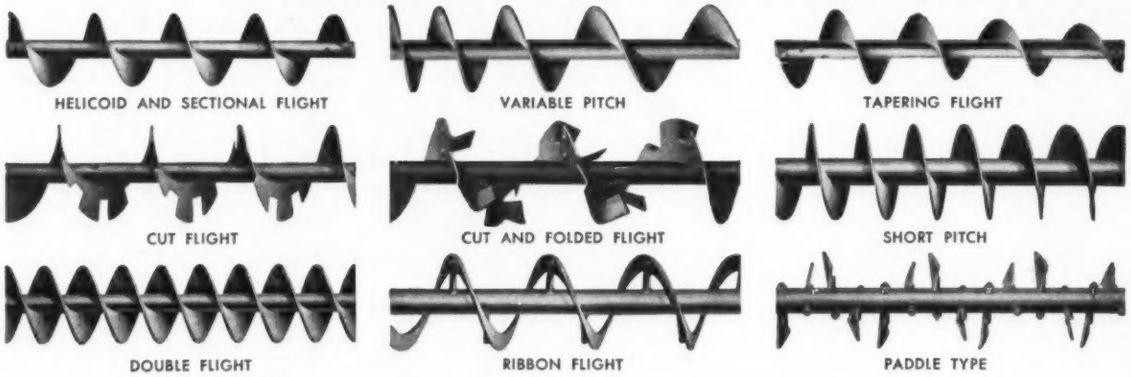
And if this wide range of *standard* conveyor screws can't solve your problem, our engineers will design an economical answer. We have furnished conveyor screws ranging from 1½ inches to over eight feet in diameter. What are your needs?

Link-Belt can also furnish helicoid and sectional flighting in a wide range of sizes, plus *all* other screw conveyor components. This includes troughs, spouts, hangers and drives.

For complete information, plus any engineering counsel you may need, contact your nearest Link-Belt office. Ask for Screw Conveyor Book 2989.

15.740

JUST A FEW from industry's widest variety of conveyor screws



LINK-BELT

SCREW CONVEYORS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Warehouses and District Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs; Switzerland, Geneva. Representatives Throughout the World.

Circle 48 on Reader-Service Card for more information

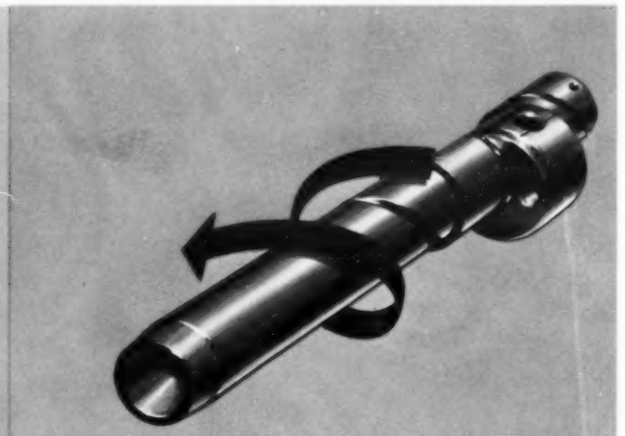
Post-Forming: New Way to Bigger Savings with Malleable Castings

The ductility of Malleable iron castings permits use of high-speed forming techniques to finish Malleable parts at lower cost. Take advantage of the versatility you get only with ferritic and pearlitic Malleable castings. For a fuller understanding of how Malleable can help you, call any producer that displays this symbol —

Free Folder describing these techniques is available for your use. Just ask any member of the Malleable Castings Council for Data Unit No. 116, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

MEMBER
MALLEABLE
CASTINGS COUNCIL

Hot Form It — Hot coining this Malleable transmission part reduces finished cost . . . eliminates three cutting operations required by the previously used steel part.



Roll It — Oil grooves in lawnmower crankshafts and splines in compressor crankshafts are just two of many places where rolling proves more economical than machining.

Punch It — Holes with diameters greater than the thickness of the metal can be punched in Malleable. Two round holes and a square hole are punched simultaneously in this idler arm.

Spin It — Malleable's ductility permits the sleeve and end disc in this ball joint to be held in place by spinning the Malleable housing into a strong, permanent flange.

Get the most for your metals dollar...get MALLEABLE

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Alloy Foundries Division, The Eastern Co., Naugatuck

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Castings Co., Indianapolis 22

IOWA
Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division, Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

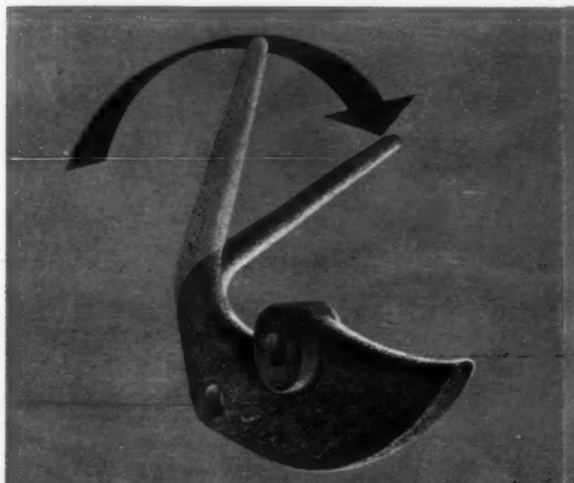
OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

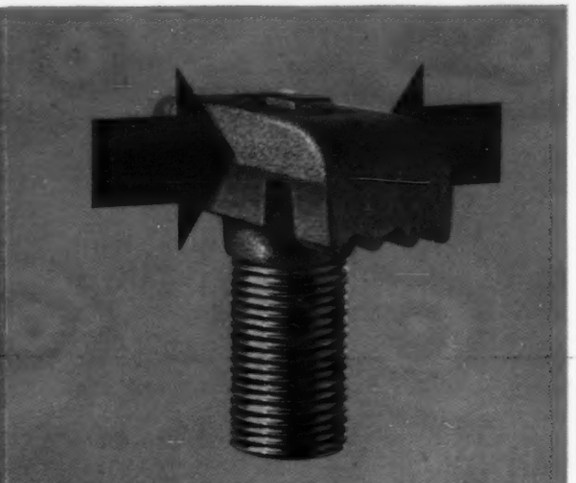
TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

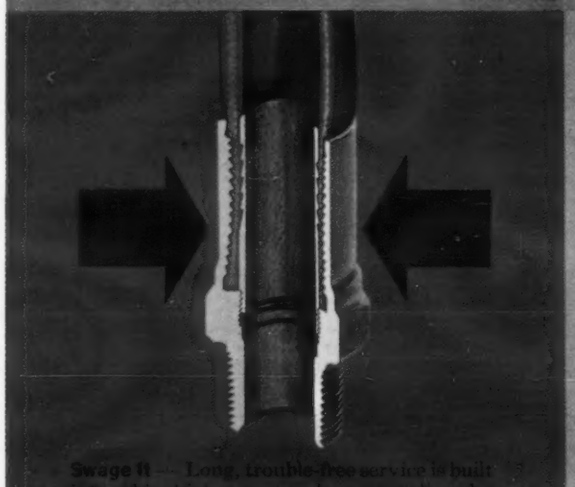
WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46



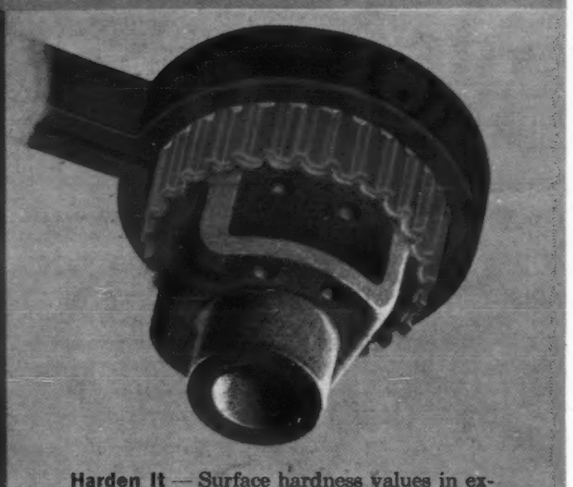
Bend It — A 30% cost reduction was achieved by casting this Malleable iron twine finger flat . . . then bending the arm about 45 degrees and coining the center hub in one fast, post-forming operation.



Coin It — Very close tolerances are often met economically by either cold or hot coining. The head of this T-bolt is coined to meet tolerances of ± .005" on its .475" width without any machining.



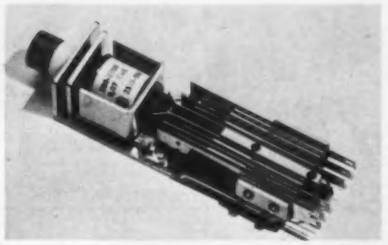
Swage It — Long, trouble-free service is built into this high-pressure hose coupling by swaging the Malleable fitting around the reinforced hose in a 15-ton press. It's fast, permanent and economical. Working pressure of the hose is 2,000 psi.



Harden It — Surface hardness values in excess of 55 Rockwell C can be achieved with pearlitic Malleable by either flame or induction hardening. Response is excellent, and results are uniform.

Circle 49 on Reader-Service Card for more information

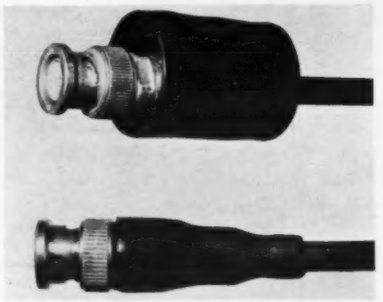
Two-Color Magnetic Pushbuttons 325



The functions of a position indicator and holding relay are combined in this line of magnetic pushbuttons. The buttons can be held in the actuated position by a tiny builtin electromagnet. They are released by switching off the magnet current. Holding current for the electromagnet is 15 ma. Switch contacts are rated for 3 amps noninductive. Use of the two-color button makes the "on-off" position easy to determine. The button measures 3-15/16 by 11/16 inch square and is available with 22 different contact combinations.

International Telephone & Telegraph Corp., Components Div., 320 Park Ave., New York 22, N.Y.

Heat-Shrinkable Boots 326



A waterproof seal for coaxial cable connectors is provided by the use of these heat-shrinkable "Thermofit" boots. The boots are supplied in an expanded form which permits easy installation after the connector has been assembled. Exposure for a few seconds to heat in excess of 250F shrinks the boot tightly into place. The boots are manufactured in a variety of sizes to fit standard TNC, BNC and Type N coaxial connectors and their matching cables.

Rayclad Tubes Inc., Oakside at Northside, Redwood City, Calif.

Here is a major breakthrough in sealing air cylinders...

the new IPC ArchSeal*

REQUIRES NO MECHANICAL ASSIST. It floats . . . it's revolutionary . . . it's so simple in design and so reliable in service you'll wonder how you ever got along without it! IPC's custom engineered ArchSeal is just what the name implies . . . an arched design with *flexing* sides.

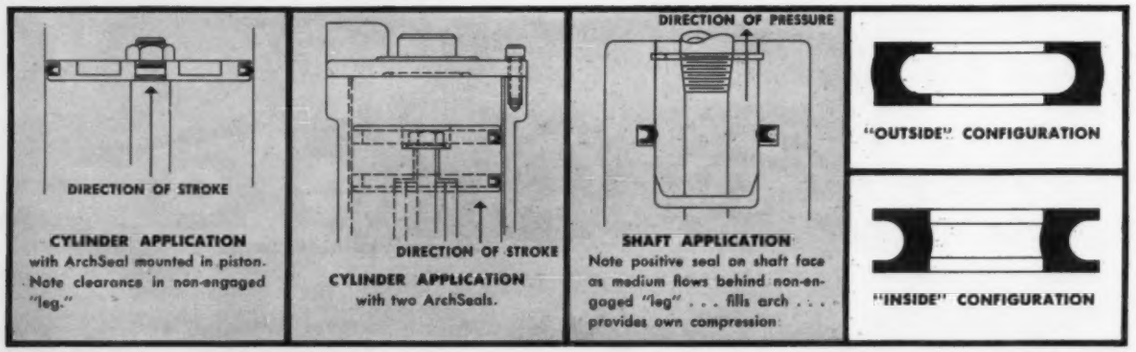
The far "leg" of this new seal moves *away* from the pressure source *instantly* . . . to provide positive sidewall sealing as the air medium flows around the non-contact leg and back-fills the hollow arch. Immediately . . . you get self compression on the *face* of the seal as the air pressure expands the face outward against either shaft or cylinder wall.

That's right! They're made for inside or outside sealing. Reverse the pressure or stroke . . . the seal reacts in the opposite direction with the same positive results!

Reliability? Many are performing perfectly now with over 20,000,000 cycles. Temperature range? From minus 30° up to 500° F.

Here's the *ideal* seal for air cylinders where no lubrication is possible. Here's the way to eliminate expensive assembly components of O-rings, U's or V's with their expanders, back-up rings, or washers. You don't need them! The ArchSeal solves the problem without extra frills.

Oh yes . . . it's an IPC "custom" product so we'll need details on your application. Don't hold back . . . the ArchSeal can be the answer for which you have been looking.


DIRECTION OF STROKE
CYLINDER APPLICATION
with ArchSeal mounted in piston. Note clearance in non-engaged "leg."
DIRECTION OF STROKE
CYLINDER APPLICATION
with two ArchSeals.
DIRECTION OF PRESSURE
SHAFT APPLICATION
Note positive seal on shaft face as medium flows behind non-engaged "leg" . . . fills arch . . . provides own compression
"OUTSIDE" CONFIGURATION
"INSIDE" CONFIGURATION

IPC

OIL SEALS
PACKINGS
PRECISION MOLDING *Custom designed for your application*

INTERNATIONAL PACKINGS CORPORATION

Bristol, New Hampshire

*Patents and Trademark applied for.

©IPC

P6

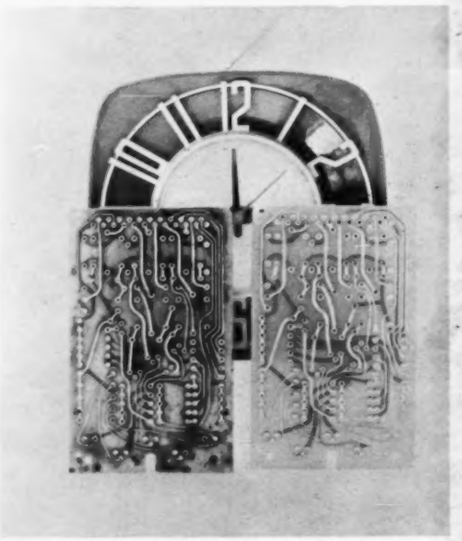
Circle 50 on Reader-Service Card for more information

Rapid-Cure Molding Material 327

Three minutes is said to be the time required for curing this polyurethane molding material. The material has good processing characteristics which are not sacrificed when it is cured at 350F for 3 minutes, three to five times faster than other gum polyurethanes now marketed. Products based on "Vibrathane 5004" have high abrasion and tear resistance, good stress-strain properties, resistance to dry-heat aging, good low-temperature performance and resistance to ozone, oxygen, fuels, oils and chemicals. The material will find application in automotive parts, hose, cable jackets, diaphragms, seals and gaskets.

Naugatuk Chemical Div., U.S. Rubber Co., Naugatuk, Conn.

Fast-Acting Rosin Flux Remover 328



Rosin solder flux is said to be removed in an average of only 6-1/2 sec per board, compared with more than 10 sec for carbon tetrachloride or other proprietary formulations. Known as "Reflux", the flux remover is compounded of organic safety solvents, is 100-percent nonflammable and is said to guarantee chemically clean circuit boards. While designed primarily for cleaning printed-circuit boards, the material also is used for cold-cleaning greases, waxes or dirt films from all metallic surfaces.

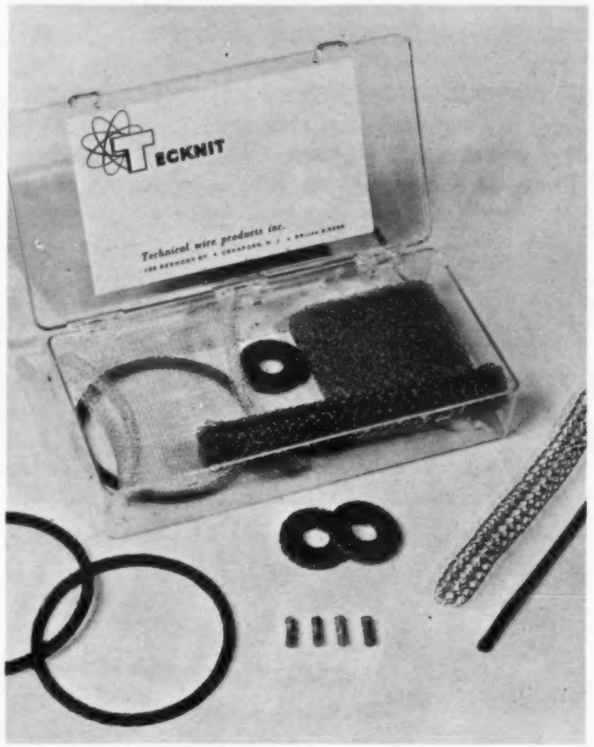
Supracote Development Lab., Inc., 17 Main St., Bloomingdale, N.J.

Woven-Wire Evaluation Kit

329

A woven-wire kit containing eight different structures having varying compression characteristics, mechanical hysteresis, temperature ranges, corrosion resistances, shapes and electrical characteristics now is offered to give design engineers an opportunity to explore new uses for the material. The sample kit includes stainless steel, "Monel," "Inconel", aluminum and gold-plated silver-copper alloy wires, with the corrosion resistance, temperature, hardness and electrical conductivity characteristics of the alloys used. The compressed knitted wire has elastic properties similar to rubber but differing in that it is truly compressible. Another unusual characteristic of the woven wire is a marked wicking or capillary action when compressed to appropriate densities. Experimenters have reported successful application of the resilient, electrical, heat-conductive material to flexible packaging, all-metal shock mounts and as a component for high-temperature gaskets.

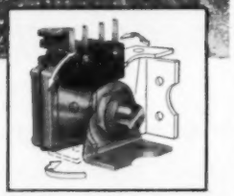
Technical Wire Products, Inc., 129 Dermody St., Cranford, N.J.



ANCHOR
THE PLEDGE OF PERFORMANCE
DEPEND ON IT!
in ANCHOR PRESSED-ON HYDRAULIC HOSE ASSEMBLIES
up to 12,500 psi working pressure
Anchor's exclusive, patented Ductile Sleeve Couplings, designed for permanent attachment to high pressure wire braided hose, together with Anchor's new Super-Spiral Wire Reinforced Hose, have made new, higher operating pressures possible and removed many previous design limitations. A plus margin of safety is provided in all Anchor Pressed-On Hydraulic Hose Assemblies . . . pulsation or shock loads, within specification limits, are efficiently and safely handled.
Working pressures from 12,500 psi for 3/16" I.D. 6-Ply, Super-Spiral Hose to 100 psi for 2" I.D. Spiral Wire Suction Hose.
Write now for Anchor Catalog No. 102
ANCHOR Coupling Co. Inc.
379 North Fourth St., Libertyville, Ill.
Branch Plants: Dallas, Tex., Plymouth, Mich.

Circle 53 on Reader-Service Card for more information

The NEW
HAGEN MODEL 90
Pneumatic Timer



Mounts anywhere in any position. Universal Mounting Bracket included.

WEIGHS LESS THAN 1 OZ.
FITS IN 1½" CUBE

This NEW miniature timer is a simple, cost-cutting solution to solving time delay problems in the products you build. It's *versatile* — with an adjustable range of 2 to 20 seconds. It's *reliable* — it's *rugged* — with a G.E. "Lexan" plastic body.

CIRCUITS— Single Circuit — Double Break — 10 Amps., 250 V.A.C. 10 Amps., 30 V.D.C. (Ind.)
Two Circuit (S.P.D.T.) — 5 Amps., 250 V.A.C. 3 Amps., 30 V.D.C. (Ind.)

TERMINALS Taper-tab quick disconnect terminals standard. (Screw type terminals optional)

OPERATING TEMPERATURE RANGE 32° to 120° F.

Each Timer comes packaged in its own plastic shock-proof container. Write for Bulletin 1630 showing further details of the Model 90 Timer.

HAGEN MANUFACTURING COMPANY
BARABOO, WISCONSIN

A DIVISION OF THE GAMEWELL COMPANY, AN E.W. BLISS COMPANY SUBSIDIARY

Circle 51 on Reader-Service Card for more information

"Dyflon"®
Self-Aligning and Self-Lubricating
SPHERICAL BEARINGS

Combine "Monoball"® Engineering Advantages with Life-Time Lubrication

Design engineers in many industries are specifying new "DYFLON"® SELF-ALIGNING and SELF-LUBRICATING SPHERICAL BEARINGS for these 5 major reasons:

1. **LOWER COEFFICIENT OF FRICTION** ...ideal where lubrication is impossible or undesirable.
2. **WITHSTAND EXTREME VIBRATION** ...perfect performance under shock load conditions.
3. **WILL NOT "COLD-FLOW"** ...even under extreme load conditions.
4. **IMPERVIOUS TO KNOWN CHEMICAL SOLVENTS** ...eliminates corrosion problems.
5. **FAIL-SAFE** ...due to "Monoball"® design.

Request Engineering manual No. 551.

In addition, due to their two-piece "MONOBALL"® design and plastic alloy insert, "DYFLON"® bearings have a long cycle life. Alignment and installation problems are minimized. Oil-free for life means lowest possible maintenance costs.

Available in a variety of plain or rod end types. Bore sizes to 3.000". Materials include stainless steel, plastic alloys and chrome alloy steels. Ultimate static loads to 500,000 lbs.

SOUTHWEST PRODUCTS CO. 1705 SO. MOUNTAIN AVE. MONROVIA, CALIF. · PHONE: MURRAY 1-9616

Circle 52 on Reader-Service Card for more information

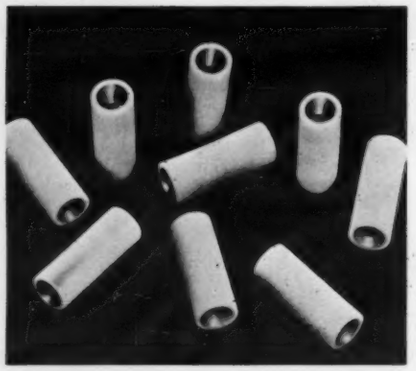
Ceramic Switch Element 330

Deflections of as much as 1/64 inch in one direction with loads to 30g are possible with this ceramic switch element. By reversing applied voltage polarity, equal displacement in the opposite direction is produced, allowing a net motion of 1/32 inch. Applications include switches, valves or other electrical devices. The ceramic elements provide these displacements with approximately 125v d-c. Application of a-c voltages provides an oscillating motion.

Gulton Industries, Inc., 212 Durham Ave., Metuchen, N.J.

Metallized Ceramic Tubes 331

Ceramics utilizing 90 to 97 percent pure alumina now are manufactured with the inside entirely metallized. The tubes are offered in sizes down to 0.080 ID with a maximum tube length of approximately 8 inches. The metallized surface is stress-free nickel plated, then subsequently



coated with tin, lead tin, tin silver or other coatings as required. A moly-manganese metallizing technique produces a bonding strength of 15/20,000 psi—a bond so strong that the yield of end products is increased substantially even after repeated processing operations.

Ceramics International Corp., 39 Siding Place, Mahwah, N.J.

POWER

BU

and a choice of 980 models makes Allison

When we first started out in this power-shift business 17 years ago, we figured we'd have to build only a handful of models. Field experience got us over that idea in a hurry. Today we build 980, so you get the model that's precisely right for your needs.

But that's just one of the things we learned building almost 175,000 power-shifts.

We found out you had to know a lot about metals if you're going to make a power-shift that stands up. So we hired professional metallurgists, installed a bank of 30 heat-treating furnaces.

We discovered it's a good idea to check out designs on an analog computer; to prove them out with pilot models on the job; to completely test every power-shift before you ship it.

And we came up with a slick way to eliminate heat buildup, complicated torque splitters and engine power waste: Use "free wheeling"—not fixed—stators in your torque converters.

A list of all the things we've learned in building power-shifts backed by quality standards unsurpassed in the industry would fill a good-size book. We haven't bothered to write it. But we've got something that's maybe more impressive.

It's a list of the many large and small manufacturers who build TORQMATIC power-shifts into their equipment—and stake a good part of their reputation on TORQMATIC DRIVES each time they do. Want their names? And the equipment they build? Mail the coupon today.

— SHIFT IS OUR SINESS

Torqmatic Drives a wise choice for your business

Allison TORQMATIC
TORQMATIC DRIVES

THE WORLD'S MOST COMPLETE LINE OF HYDRAULIC DRIVES
Over 980 Models used by 125 Manufacturers In
100 to 600 H. P. Equipment

ALLISON DIVISION OF GENERAL MOTORS
BOX DN-12, INDIANAPOLIS 6, INDIANA

Please send me the list of equipment built with Allison TORQMATIC DRIVES.

Name_____

Title_____

Company_____

Street Address_____

City_____ Zone_____ State_____

Circle 54 on Reader-Service Card for more information

Heat-Resisting Ink 332

Designed for making identifying marks on steel, copper and brass and on welding rods, this heat-resisting ink is able to withstand temperatures to 2500F. The ink is called "Okie Heat-Resisting Yellow" and will not rub off under high temperatures. The product is marketed in 1- to 55-gal drums.

F. G. Okie, Inc., Ambler, Pa.

Etchant for 'Teflon' 333

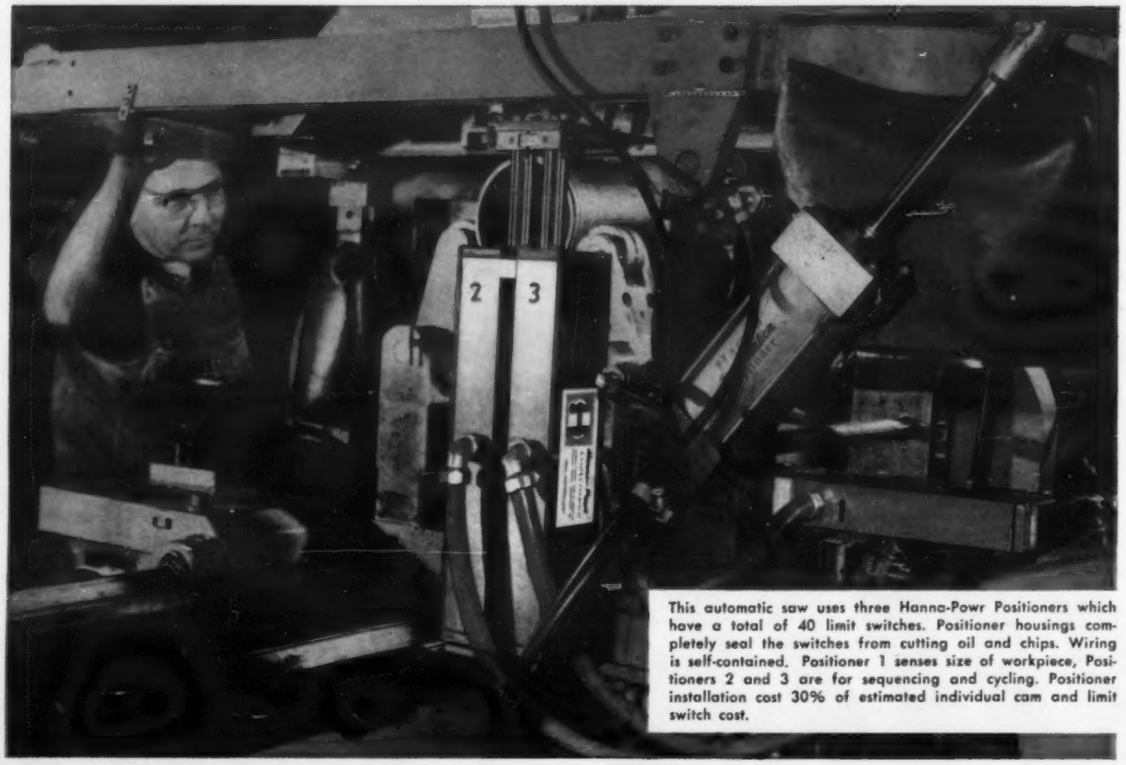
Ordinary adhesives now may be used to bond "Teflon" or "Kel-F" plastics to many other materials after the use of this etchant solution. By first etching the "Teflon" or "Kel-F" with "Fluorobond" solution, bond strengths as high as 55 lb per inch peel strength are reported, depending upon surface finish and cleanliness.

Joclin Mfg. Co., Lufbery Ave., Wallingford, Conn.

Domestic Fused Quartz 334

"Ultrapure" fused quartz made from domestic supplies now is available. The quartz has higher thermal resistance, enabling it to withstand high temperatures for longer periods of time. Tests have shown that the material deforms at less than half the rate of the former imported quartz when subjected to temperatures of 1200C and higher. The tubing and rod produced from the new domestic source devitrifies much more slowly, remaining more transparent at high temperatures. The high-purity fused quartz will be particularly beneficial to the nation's research and development laboratories, where even the smallest trace of impurities may present problems. An assortment of sizes is available with special shapes made to customer specifications.

General Electric Co., Nela Park, Cleveland 12, Ohio.



This automatic saw uses three Hanna-Powr Positioners which have a total of 40 limit switches. Positioner housings completely seal the switches from cutting oil and chips. Wiring is self-contained. Positioner 1 senses size of workpiece, Positioners 2 and 3 are for sequencing and cycling. Positioner installation cost 30% of estimated individual cam and limit switch cost.

Start a cam and limit switch COST REDUCTION PROGRAM!

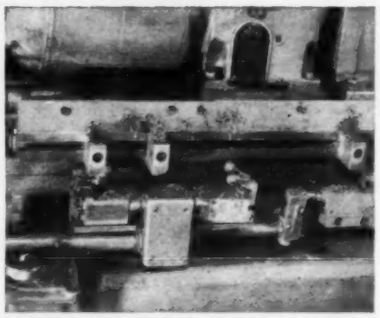
You can cut cam and limit switch costs up to 70% by using the Hanna-Powr Positioner — a compact, dust and water-tight housing containing cam rods and limit switches.

Because the Positioner is a pre-engineered assembly, it saves time used in designing special cams and mountings. Installation costs are cut, too, because it is only necessary to mount one box (4 screws) rather than individual switches and cams. Wiring is greatly simplified. The Positioner housing serves as a junction box—one conduit connection does it.

The switches can be moved easily and locked quickly in place after installation. This speeds set-up time for new jobs and makes pre-calculation of stops unnecessary. Safety is another big advantage—the switches cannot be tripped accidentally.

In addition to lower initial costs —maintenance, replacement, and down-time costs are cut. Switches last longer due to the protection (from dirt, chips, fluids and damage) afforded by the sturdy, extruded aluminum housing.

Use Hanna-Powr Positioners for cycling, sequencing, positioning, sensing and indicating. Many are in use and have been thoroughly tested in a variety of applications. It's a practical approach to automation.



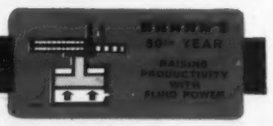
Examine your cam and limit switch costs. $35 to $75 per switch is the cost companies have fixed for designing, machining, installing, wiring, and adjusting limit switches and cams. This photo shows a typical high cost installation where oil, chips and accidental damage cause high failure rates and increased maintenance costs.

Positioner containing switches and cam rods. Up to 28 switches per foot of travel. Any travel to 8 feet. Takes standard miniature or heavy duty limit switches, single or double throw.

Write for complete catalog or consult Sweets' Product Design File section 9A/HA. Your Hanna Representative will also give you complete information—see the yellow pages under cylinders.

Hanna Engineering Works

1746 Elston Ave., Chicago 22, Illinois
AIR AND HYDRAULIC CYLINDERS, VALVES, POSITIONERS



Circle 55 on Reader-Service Card for more information

MATERIALS

High-Impact Acrylic Powder 335

A change in formulation doubles the highest impact strength previously available in this line of high-impact acrylics. The material has a high degree of transparency in natural color, increasing the range of color possibilities and adding luster and color depth to molded parts. "Implex R" contains no plasticizers, is dimensionally stable, low in water absorption, resistant to staining and chemical attack, and free of odor or taste. Parts molded of the new acrylic powder can be cut, drilled, machined or solvent-cemented. Applications include housings and control knobs for business machines, electrical appliances, portable radios or industrial and laboratory equipment. Parts molded with a wall thickness of 1/8 inch or less in natural color are transparent enough for observation of liquid or powder levels in molded containers.

Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.

RF Shielding Caulking Compound 336

This material is both an airtight, watertight, corrosion-free sealer for conduit joints or threads and an RF-tight caulker for shielded enclosures. In the latter application, insertion losses in excess of 100 db from 200 kc through 10 kmc furnish shielding effectiveness comparable to that obtained in all-welded construction. "Eccoshield VX" is a one-component material, silver-black in color, of paste-like consistency. It does not harden with time, allowing disassembly of threads or joints for subsequent reassembly as desired. The material is removed easily with conventional solvents. Electrical conductivity compares favorably with many metals, with volume resistivity of the paste less than 0.1 ohm-cm.

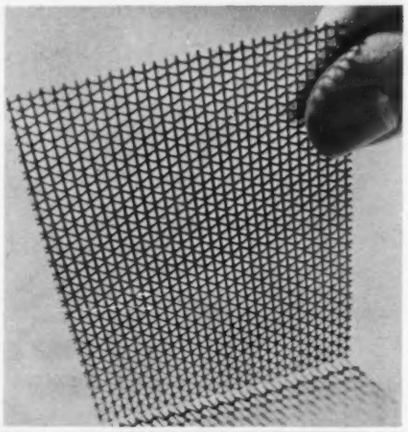
Emerson & Cuming, Inc., Canton, Mass.

Aluminum Foil Vulcanized to Rubber 337

Aluminum sheet and foil now can be vulcanized to rubber, yielding a material having the surface toughness, corrosion resistance and heat insulative values of aluminum while retaining the flexibility of rubber. The process is made possible by a special rubber coating applied to the aluminum. When the rubber is vulcanized, the aluminum becomes an integral part, as difficult to remove as the thread on an automobile tire. Proposed applications include tenting and tarpaulins, aluminum tire cords and flexible aluminum-covered pipe or tubing.

Reynolds Metals Co., Richmond 18, Va.

Stainless-Steel Wire Cloth 338

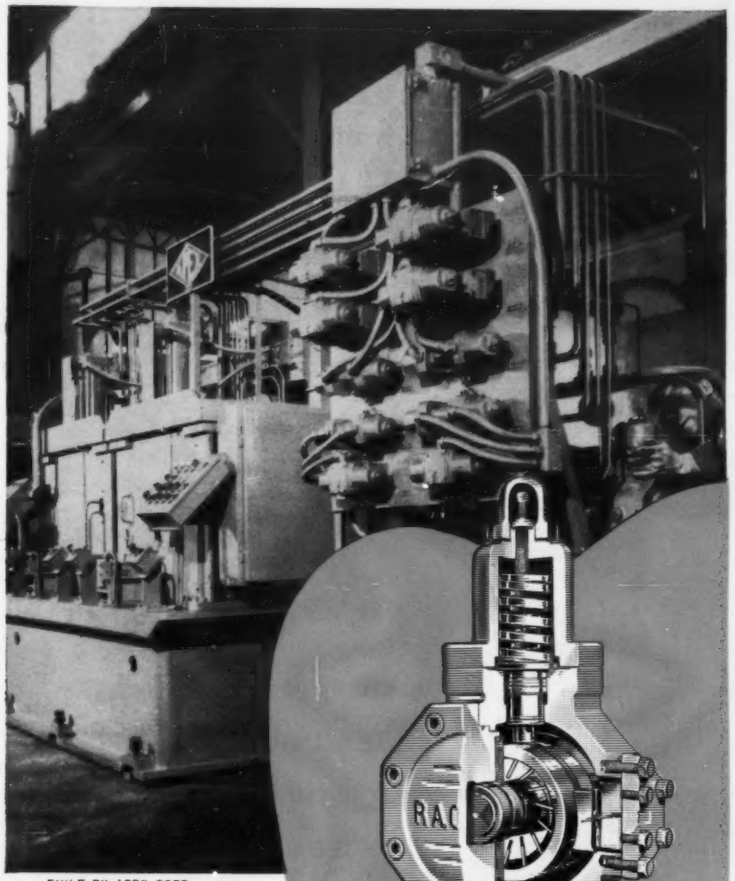


By using stainless-steel alloy NS-A286, a wire cloth comparable to the more highly alloyed materials in the 600 to 1000F range has been produced. The alloy allows deeper forming of wire-cloth parts than was previously possible with mesh woven of hard temper wire and parts made with the stainless alloy can be hardened after forming or fabricating. The wire cloth can be made in various meshes, wire sizes and weaves and is used in jet engines, gas turbines and other elevated-temperature applications.

National-Standard Co., Reynolds Div., Dixon, Ill.

DAMASCUS — 6500
DAMASCUS DRAWING
2H
"... and not only that...
but Damascus is the only line of pencils Electro-Calibrated for exact grading uniformity. That means that the step from one degree to another is always identical. When you reach for a 4H, you get a 4H . . . and when you switch to a 3H, you know exactly what the variation will be. Why not pick up a set—and some leads for your holder, too, they're identical with the pencils."
DAMASCUS DRAWING PENCILS, HOLDERS AND LEADS • TAD ERASERS

Circle 56 on Reader-Service Card for more information



BUILT BY APEX CORP., ROSEVILLE, MICHIGAN

This active hydraulic heart helps

the HEART of this impregnating machine is a RACINE MODEL 6FA PUMP

SEAL POROSITY IN 106 TRANSMISSION CASES EVERY HOUR

A RACINE VARIABLE VOLUME PUMP and 10 RACINE VALVES control *all* mechanical operations in this Apex impregnating machine, which seals leaky transmission cases at a major auto firm's transmission plant in Toledo, Ohio. Apex specified RACINE equipment because its design simplifies machine design problems . . . eliminates the need for extra pumps and valves. RACINE PUMPS are easy-to-control . . . handle pressure compensation *automatically* for varying gpm requirements. Apex has *preferred* RACINE for over 10 years!

RACINE

Racine Hydraulics & Machinery, Inc.
RACINE, WISCONSIN
HYDRAULICS DIVISION

Circle 57 on Reader-Service Card for more information

SWORD WITH A POINT The sword of hope of the American Cancer Society offers ✦ **HOPE** for the cancer patient today: One in three is being saved, compared with one in seven only twenty-five years ago. The American Cancer Society's public education messages are alerting more and more people daily to the vital importance of regular health checkups, to the urgency of early diagnosis and proper treatment, and to a host of other life-saving facts about cancer.

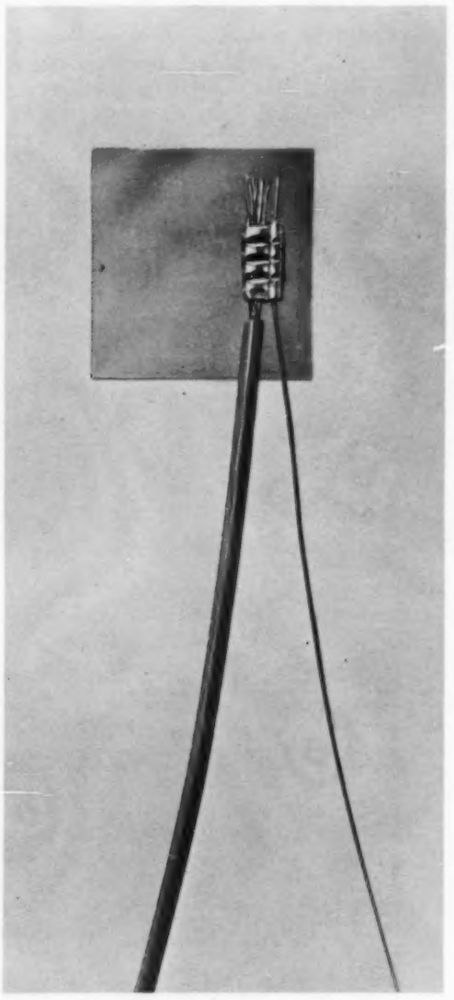
✦ **HOPE** for the family of the cancer patient: They can turn to the Society's service activities for assistance in relieving physical and psychological problems. ✦ **HOPE** for tomorrow's cancer patient: He will benefit from his physician's knowledge of latest advances in the diagnosis and treatment of cancer—knowledge largely provided through the American Cancer Society's professional education program. And, through the Society's vast research program, important new discoveries are being made which can ultimately mean an end to cancer. ✦ This is the program of the American Cancer Society. Its sword of hope points the way to a future free of cancer. AMERICAN CANCER SOCIETY

EQUIPMENT

Small Wire Splicer 339

This machine splices fine-stranded wire of 26 gage or smaller to 34 to 44-gage fine magnet wire. The machine feeds a U-shaped splice mounted on "Mylar" tape into the applicator. An operator feeds the fine magnet wire into a stripping wheel, then into the splice. The stranded lead wire then is placed in the splice and by actuating a foot pedal, the splice is crimped, the fine wire, lead wire and "Mylar" tape are sheared by a blade and the next splice is fed into position. The "Fine-Y-R" splicer completes approximately 300 splices per hr compared with 30 per hr with solder methods. The technique is expected to find applications in the manufacture of small transformers, relay coils, solenoids, inductors, feed coils or similar components.

AMP, Inc., Harrisburg, Pa.



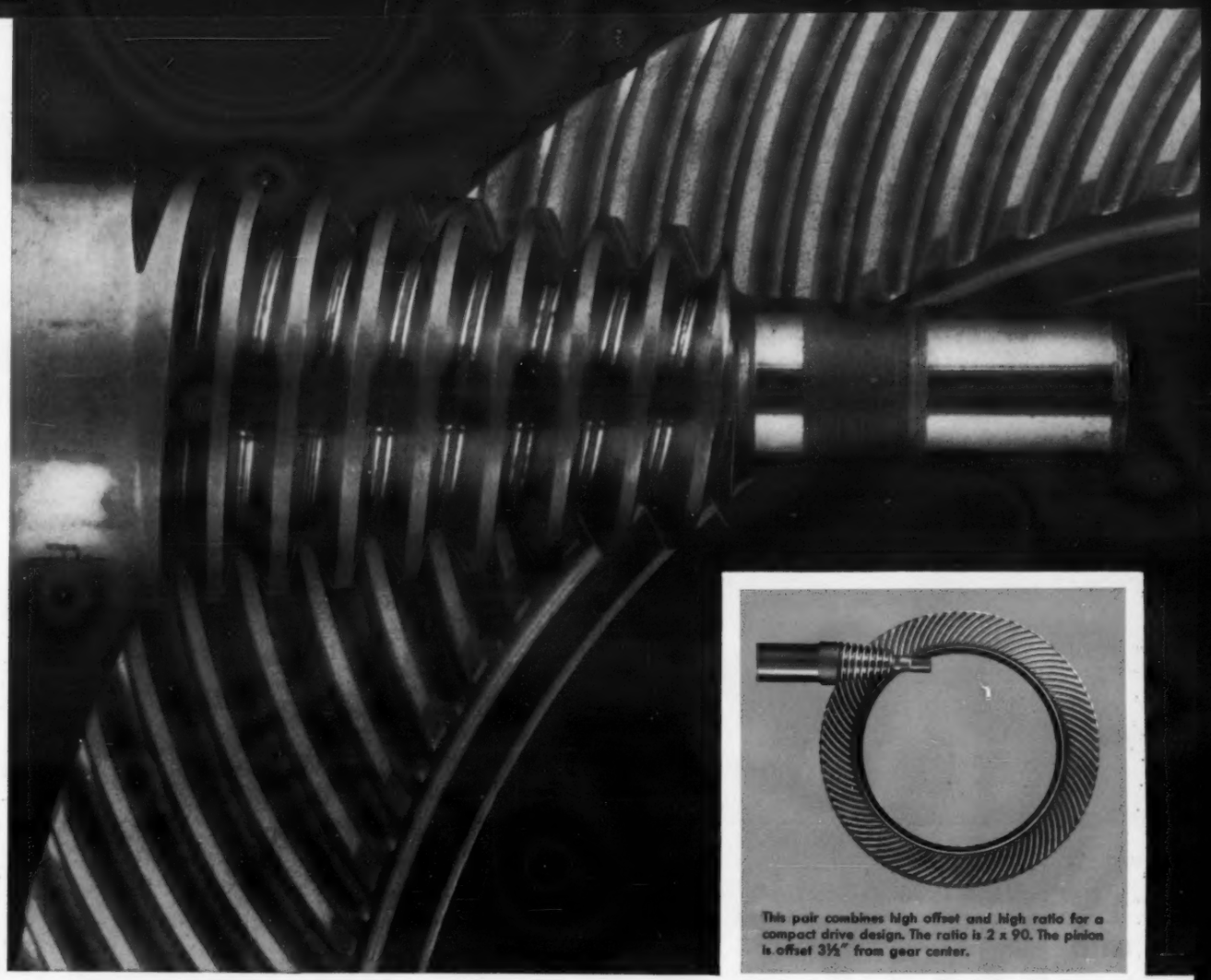
Transistorized Potentiometer **340**

Combination of a zero-temperature coefficient Zener diode with a transistor amplifier and a small null indicator meter provides a rugged, accurate, stable potentiometer. Accuracy of the instrument is said to be ±0.05 percent of reading or 0.5 mv, whichever is greater, over a range from 0 to

5.100v d-c. At balance, the potentiometer input impedance is infinite. A current-volt box is available to extend the range to 0.5-5-50-500 ma, 1 amp or 5-50-500v.

Sensitive Research Instrument Corp., 310 Main St., New Rochelle, N.Y.

Circle 59 on Reader-Service Card



This pair combines high offset and high ratio for a compact drive design. The ratio is 2 x 90. The pinion is offset 3½" from gear center.

See how the teeth "wrap around" this high-reduction pinion

This is a high-ratio hypoid gear. In principle, it is not different from more conventional hypoids produced by the Gleason Works. *But . . .*

If you look closely at the pinion, you'll notice that the teeth tend to "wrap around" it. This design is extremely well suited for high reduction, strength and compact design.

The result is a conical (or sometimes cylindrical) pinion which permits *continuous tooth action—even with just one or two teeth!* Compared to corresponding bevel pinions, its diameter is greater for higher strength. An extended shank on cylindrical pinions makes *very rigid* straddle mountings practical.

You can design a *compact* unit, because high offset is possible! For high-offset *or* high-ratio pairs, the "wrap around" tooth design provides an extra measure of the smooth, quiet tooth action of hypoid gears.

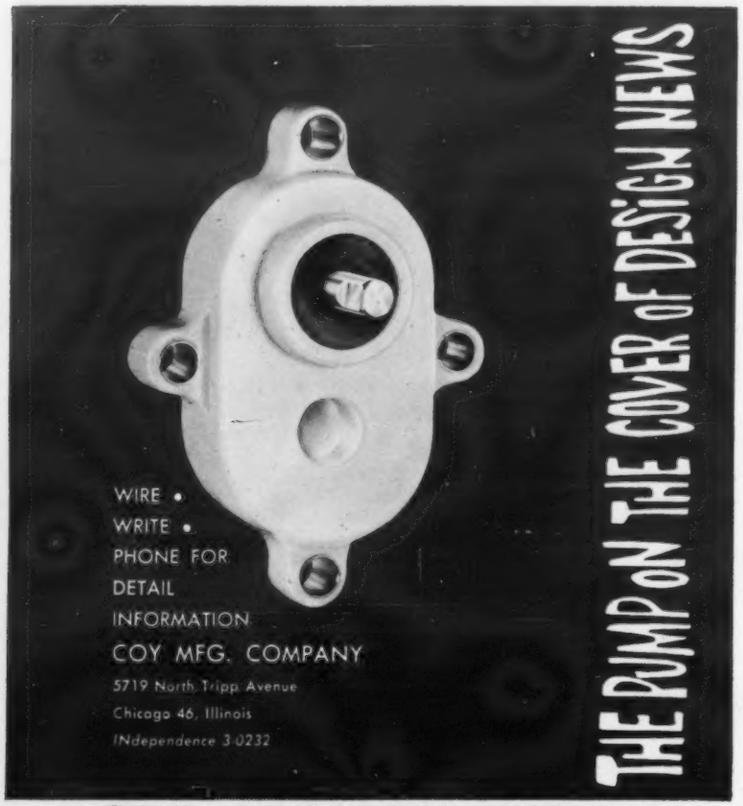
High-ratio hypoids can be cut on the same Gleason equipment that is used on more familiar spiral bevel gears and hypoids. You can also use the same testers, quenching presses and other auxiliary Gleason equipment you're using now. Grinders are available for applications requiring precision finish.

High-ratio hypoids can be produced by the Gleason Works for ratios of 1:10 or 1:40 or even higher. They are finding a growing number of applications in such diverse fields as farm machinery, instrumentation and office equipment.

You can get more information about Gleason high-ratio hypoid gears by writing for free literature. Submit your prints for recommendations.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.



Circle 60 on Reader-Service Card for more information

Here's How Haveg Solved the Problem...

with HAVELEX®

PRECISION MOLDED RIGID INORGANIC INSULATING MATERIAL

Havelex is used as an **Arc Quencher**—part encapsulates a 100 amp electrical break in a switch for the U. S. Navy requiring 1200 amps (12 positions).

Mason Electric Corporation Reliability Laboratory had a request to up-rate an existing switch from 35 amps load at 28v DC, 115v AC to a 100 amps load.

PROBLEM: Existing thermosetting and thermoplastics including the new exotic materials could not fulfill these requirements under life testing.

SOLUTION: Havelex 2802 material met or exceeded the MEC Laboratory requirements. Mr. E. V. Lunenschloss, Chief Engineer at MEC, is completely sold on *Havelex* and wrote, "It isn't too often that any of us have the good fortune of finding a material that fulfills our needs perfectly."

Haveg engineers welcome the opportunity to work with you on your particular project—to help you "Keep ahead with Haveg." Remember—Havelex offers all of these unique features: **Dimensional Stability • 1000°F. Continuous Temperature Resistance • Dielectric Strength • Mechanical Strength • Low Loss, Low Power Factor • Arc Resistance • No Moisture Absorption • Integrally Molded Metal Inserts • Hermetically Sealed Inserts.**

Please address inquiries to Sales Manager, Havelex

Keep Ahead with HAVEG. FIRST IN *Engineered* PLASTICS

TAUNTON DIVISION
HAVEG INDUSTRIES, INC.
336 Weir Street • Taunton, Massachusetts
Telephone VAndyke 4-4011

Circle 61 on Reader-Service Card for more information

EQUIPMENT

Electronic Circuit Protector 341

Operating in 2 millisec, this electronic circuit protector can greatly reduce equipment loss and downtime. The current-sensitive device operates between 5 and 500 ma d-c with a usable voltage range from 0 to 450v d-c. With the load disconnected, the protector will recycle in 4 sec or repeat recycle time with an overload present in less than 20 millisec. The unit may be operated manually with a pushbutton reset. Special ranges are available for protection of circuits at currents below 5 ma or above 500 ma.

Electronic Aids, Inc., 2615 Windsor Ave., Baltimore 16, Md.

Battery-Operated Erasing Machine 342

A reversing switch and two-speed motor are said to deliver the right rpm and torque for rapid and perfect erasing on any type of material. This portable, battery-operated, erasing machine is housed in an unbreakable plastic case styled in attractive colors. The erasers are small in diameter, eliminating the need for erasing shields, and are replaceable in seconds. The "Erase-Horse" is driven with a low-drain, permanent-magnet motor powered with two standard C-sized batteries.

"Erase-Horse", Inc., Box 20104, Houston 25, Tex.

LET MUELLER MAKE IT!

Mueller Brass Co. of Port Huron is much more diversified than the name "Brass" implies . . . a lot more. In fact, because of its many and varied facilities . . . its *men, methods* and *metals* . . . Mueller is in the unique position of being able to offer true single source service.

MUELLER HAS THE MEN . . . experienced engineers with the ability to work out, creatively, tough design problems, and improve a part or components for production by the most economical method. You get sound engineering plus 44 years of practical metalworking production experience when you "Let Mueller Make It."

MUELLER HAS THE METHODS . . . when you "Let Mueller Make It", you are utilizing one single source that is able to produce parts any one of these ways: as forgings, impact extrusions, sintered metal parts, screw machine products, formed tube or as castings.

MUELLER HAS THE METALS . . . and the materials . . . to produce precision parts in aluminum, brass, bronze, copper, iron, and steel in hundreds of different alloys to meet each exact requirement.

In addition, Mueller Brass Co. has complete and modern facilities for performing all types of finishing and sub-assembly operations. Another plus value is nation-wide sales engineering service.

So, in the final analysis, no matter where you fit in the American industrial picture, whether you're making missiles or mowers... and no matter where you're located, it will pay you to LET MUELLER MAKE IT!

MUELLER BRASS CO.
PORT HURON 23, MICHIGAN

Circle 62 on Reader-Service Card

Microminiature Stereo Camera 343

Designed for completely automatic operation, this camera measures 7/8 inch long by approximately 3/8 inch in dia. Complete with integral flash, shutter and film-changing mechanism, the camera will take from 6 to 13 stereo exposures, or 12 to 26 single exposures. The camera lens system is a modified tessar triplex 86-deg wide angle with F8-lens having a depth of field from 1/4 to 5 inches. Film used in the camera is 5 mm in width and is said to have been enlarged 100 times without appreciable image loss. Applications include inspection of inaccessible areas and in medical research.

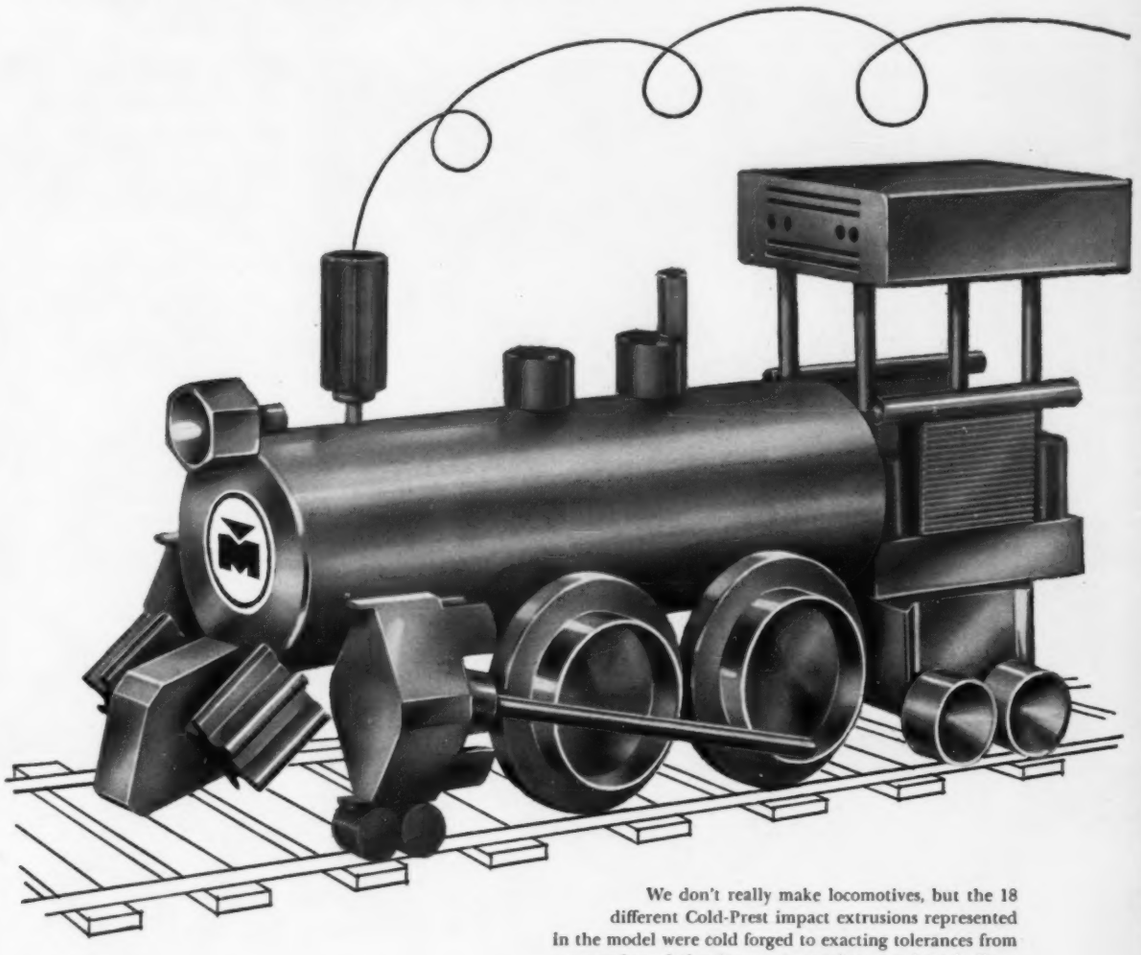
Cam Corp., Miniature Research Products, 553 Boston St., Lynn, Mass.

Proportional Laboratory Controller 344

True proportional control is provided at liquid-level, pressure, vacuum or temperature with this transistorized, crystal-controlled device. The system senses the position or level of a conductive liquid in a thermometer or a manometer. Control to within 0.1C is said to be maintained easily, depending upon the overall system or process. The "Brookstat" will control output load up to 15 amps, 115v a-c (noninductive).

Brooks Instrument Co., Inc., Hatfield, Pa.

MUELLER CAN MAKE MOST ANYTHING IN IMPACT EXTRUSIONS...



We don't really make locomotives, but the 18 different Cold-Prest impact extrusions represented in the model were cold forged to exacting tolerances from a number of aluminum, copper, brass, and steel alloys.

These parts are employed in products ranging from door closers to missiles. Mueller has also made important advances in the production of copper impact extrusions that are especially adaptable to electronic applications. Cold forgings are precision produced to exacting tolerances and offer the additional advantage of a better finish and appreciable metal savings.

Mueller's flexible facilities for the production of Cold-Prest Impact extrusions make practical long or short runs of simple or relatively complex shapes on an economical basis. In addition, the entire Mueller engineering staff, excellent machining, finishing and assembly facilities are readily available to you when you . . .

LET MUELLER MAKE IT!

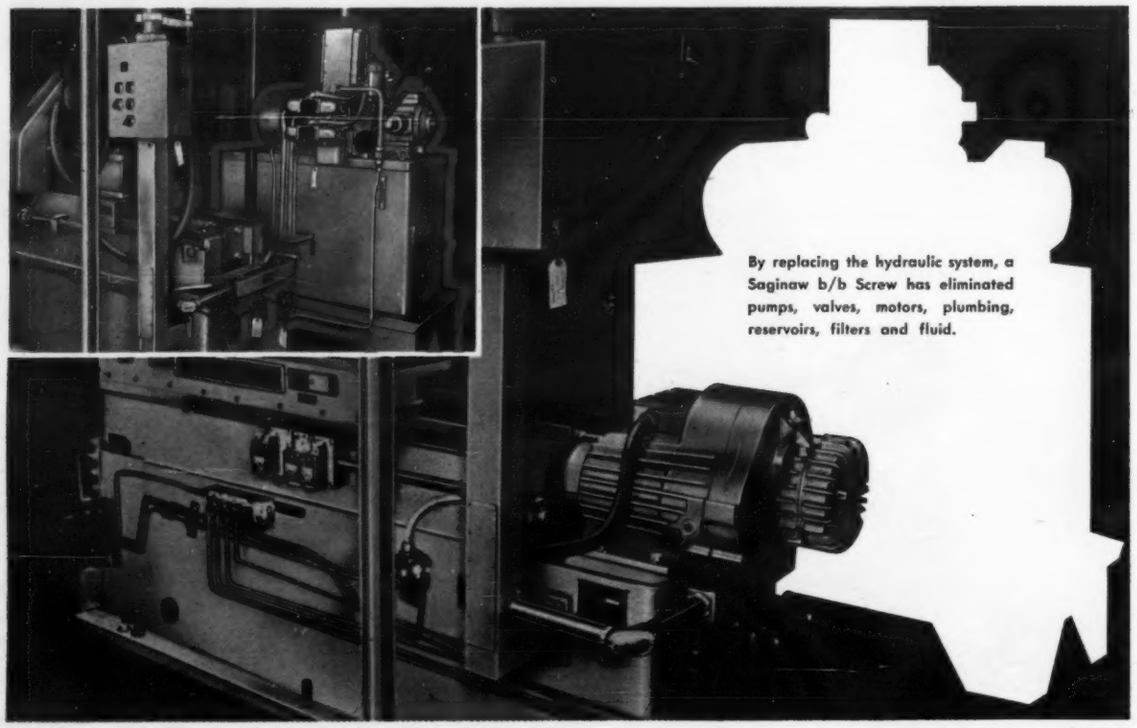
MUELLER BRASS CO.
PORT HURON 23, MICHIGAN

Write today for Engineering Manual No. FM-3019

344

Circle 63 on Reader-Service Card for more information

EFFICIENCY in a world of motion



By replacing the hydraulic system, a Saginaw b/b Screw has eliminated pumps, valves, motors, plumbing, reservoirs, filters and fluid.

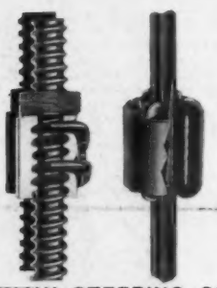
b/b screw leaves room to spare

THE SPACE-SAVING Saginaw Ball Bearing Feed Screw on this automatic transfer machine is far more efficient, economical and maintenance-free than the hydraulic system it replaced. *High Efficiency* — more than 90% — is the secret of its superior performance.

Uniform feed despite load changes caused by hard or soft spots or interrupted cuts frequently doubles cutting tool life! The need for power sources, gears and controls is reduced . . . operating costs are less . . . housekeeping and maintenance are minimized.

Which of these Saginaw b/b Screw advantages are important to you?

HIGH EFFICIENCY exceeding 90% of input;
LIFE predictable within 10%;
STEPLESS CONTROL over the entire length of the stroke;
HIGH REPEATABILITY of any position;
PRECISE POSITIONING — no stick-slip or expansion due to friction induced heat;
EASE OF SYNCHRONIZING multiple units;
SMALLER COMPONENTS in the power source and drive transmission, and
RELIABILITY under varied operating conditions.



WRITE TODAY FOR NEW DATA BOOK OR SEE SWEETS CATALOG FILE

Saginaw ball/bearing SCREWS and SPLINES

SAGINAW STEERING GEAR DIVISION • GENERAL MOTORS CORPORATION • SAGINAW, MICHIGAN

Circle 64 on Reader-Service Card for more information

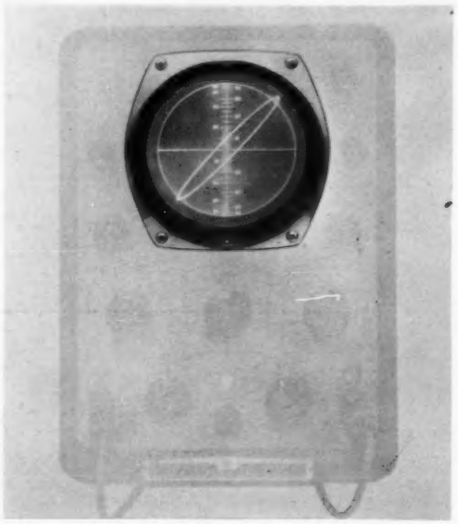
EQUIPMENT

Meter Linearity Tester 345

Deflection linearity of d-c meters may be tested easily with this device. The Model 113 checks 10 cardinal points with an accuracy of ±0.2 percent or better on meters having full-scale sensitivity from 50 microamps to 1 milliamp. Undamped meters are tested by switching a variable shunt across the meter terminals. Part of the instrument is a highly precise 10-step attenuator of low resistance which permits a high degree of testing accuracy.

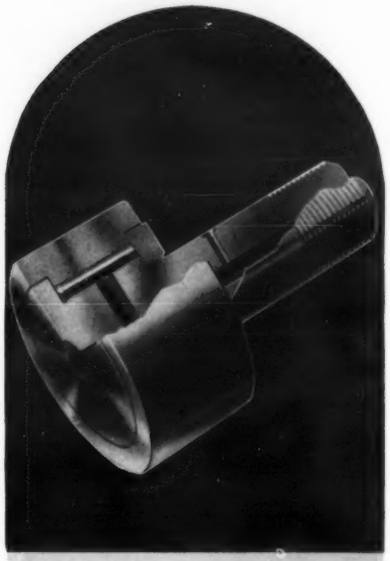
IB Instruments, Box 2460, Cleveland 12, Ohio.

Oscilloscope Phase Scale 346



Phase relationships between two synchronous wave forms are read with this oscilloscope phase scale. The transparent, machine-engraved, "PHA-ϕ-SCALE" replaces the standard grid reticule. The vertical axis is calibrated in degrees, permitting direct-phase measurement between signals applied to the oscilloscope X and Y axes. Models are available to fit both 5- and 3-inch cathode-ray tubes.

Walker Pacific, Box 2242, La Puente, Calif.

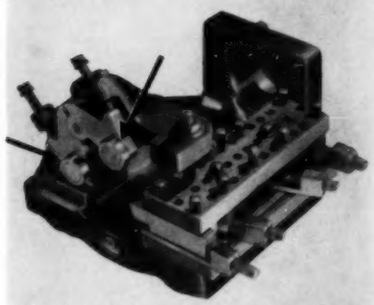


McGILL® CAMROL® BEARINGS

are proven performers—with cost and assembly advantages

McGILL CAMROL bearings have rolled up an unequalled 25-year history of high performance and dependability — with the cost savings of standard bearings over built up shaft and roller units. They eliminate the time-consuming intricacies of procurement and assembly of parts for improvised bolt, bearing and washer followers. You, too, can rely on the designed-in ability of CAMROL bearings to accept intermittent shock and fluctuating heavy loading coincident to cam action, track or guide and support applications. CAMROL bearings are built for stock in roller diameters from ½" to 4" in the CF series with integral stud and the CYR series for shaft mounting. Both types are available with or without positive, integral seals for retention of prelubrication and protection against contaminants. Following are typical applications.

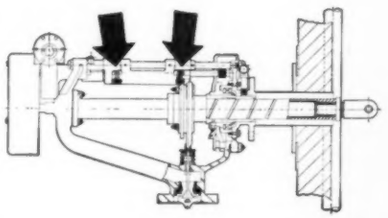
GISHOLT MACHINE COMPANY incorporates McGILL CAMROL® bearing accuracy into tooling set-ups

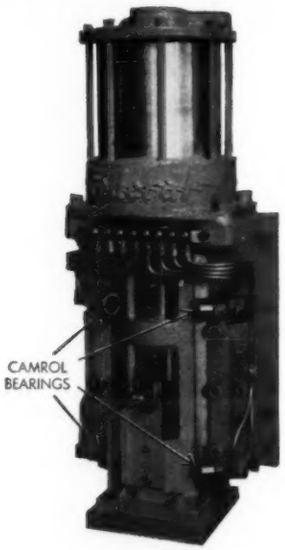


Gisholt Machine Company takes advantage of the cost and performance features of CAMROL CF series bearings, (with integral stud), on a group of standard bar tools for mounting on the turrets of Gisholt Masterline Turret Lathes. A representative tool of this group is the Multiple Cutter Turner shown.

CF CAMROL® bearings provide rolling contact in automatic soot blowers

Diamond Power Specialty Corporation has incorporated McGILL CAMROL bearings into the design of their Model IR Short Retraction blowers to produce a smooth rolling contact between cam flange and latch bar. This equipment is used for cleaning water cooled furnace walls, hopper slopes or narrow portions of tube banks adjacent to walls automatically.





FEDERAL MACHINE and WELDER COMPANY puts McGILL uniform quality into welding equipment

The anti-friction welder head unit, shown, is one of the several applications of McGILL CF CAMROL bearings in Federal Machine and Welder Co. equipment. CAMROL bearings are used in weld heads, transfer slides and various other uses where a precision, smooth, uniform movement is desired. Low cost, uniform quality, excellent performance and exceptional length of life are benefits gained in eleven years of use of CAMROL bearings.

Both the regular CF Series and the prelubricated and sealed SCF Series CAMROL bearings are used in Federal equipment.

engineered electrical products

McGILL®

precision needle roller bearings

Send for free copy of McGILL Bearing Catalog No. 62.

MULTIROL-GUIDEROL-CAMROL-CAGEROL

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203 N. Lafayette Street, Valparaiso, Indiana

Circle 65 on Reader-Service Card for more information

Circle 66 for more information on Cutler-Hammer Products shown inside

Now! Make any pushbutton station you want with new, completely versatile Cutler-Hammer oiltight pushbuttons

Choose from a complete line of operators, get greater circuit flexibility than with any other make

To meet today's need for a broad range of oiltight pushbuttons, Cutler-Hammer gives you a new versatile line.

You can get these rugged proved pushbuttons in one hole or base mounting, six bright colors. More than thirty different circuit arrangements are available plus hundreds of varieties of stations in standard arrangements of up to 25 elements. And you can get up to 8 circuits on one pushbutton. The flexible oil resistant diaphragm behind the button is designed to stay soft and pliable permanently.

With Cutler-Hammer pushbuttons you can get more control in less space, too, because they use 40% less behind the panel space than the next smallest unit.

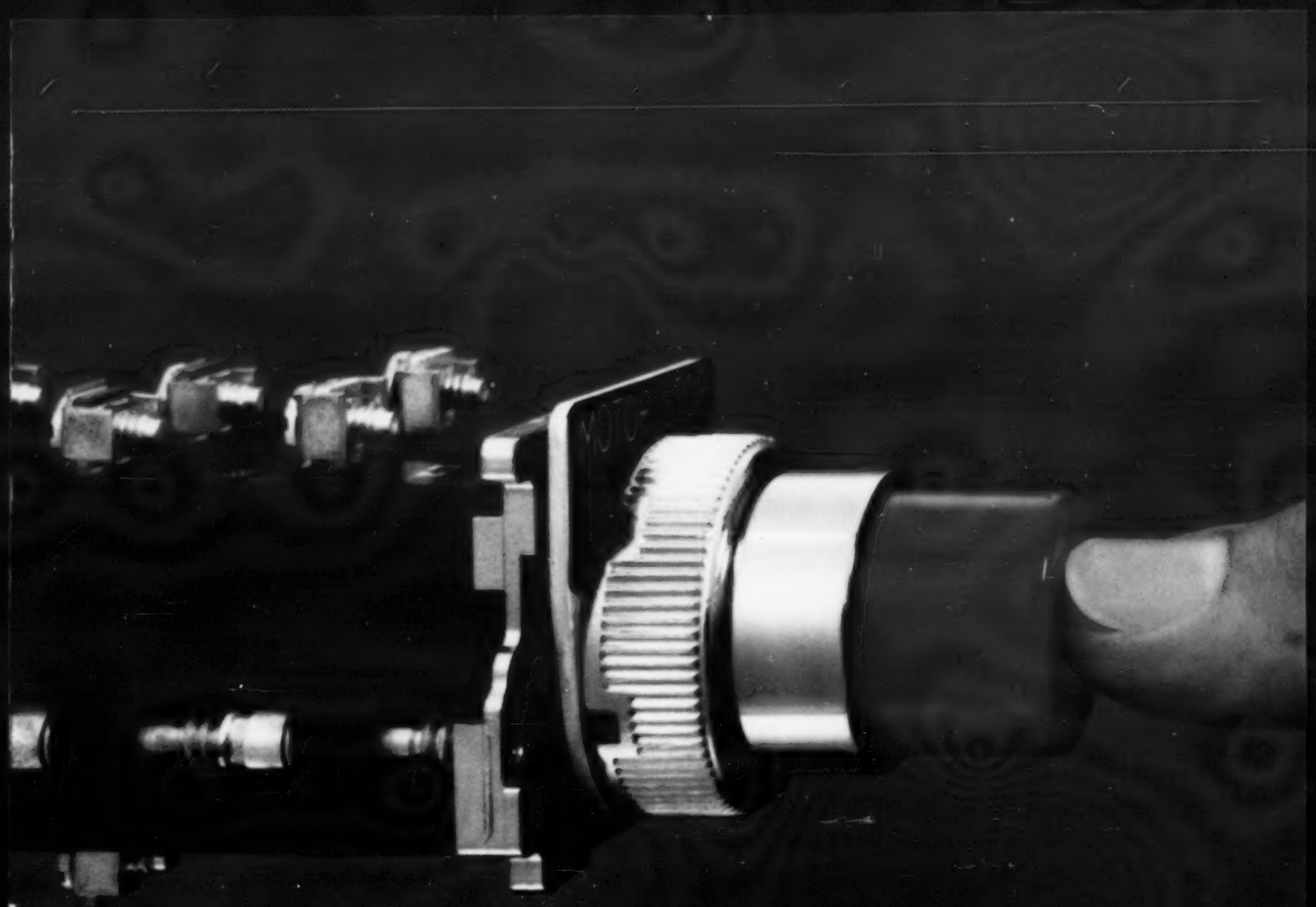
Get all the facts by sending for the colorful brochure, "MASTER DESIGN" which tells you all about the Cutler-Hammer line. Ask for Pub. LO-104.

What's new at Cutler-Hammer? You can see the newness in the products coming from Cutler-Hammer, like the new smaller pushbuttons; in the new manufacturing facilities; in the new engineering ideas. All to give you better service today and in the future. Contact the nearest Cutler-Hammer sales office or your Cutler-Hammer distributor.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.



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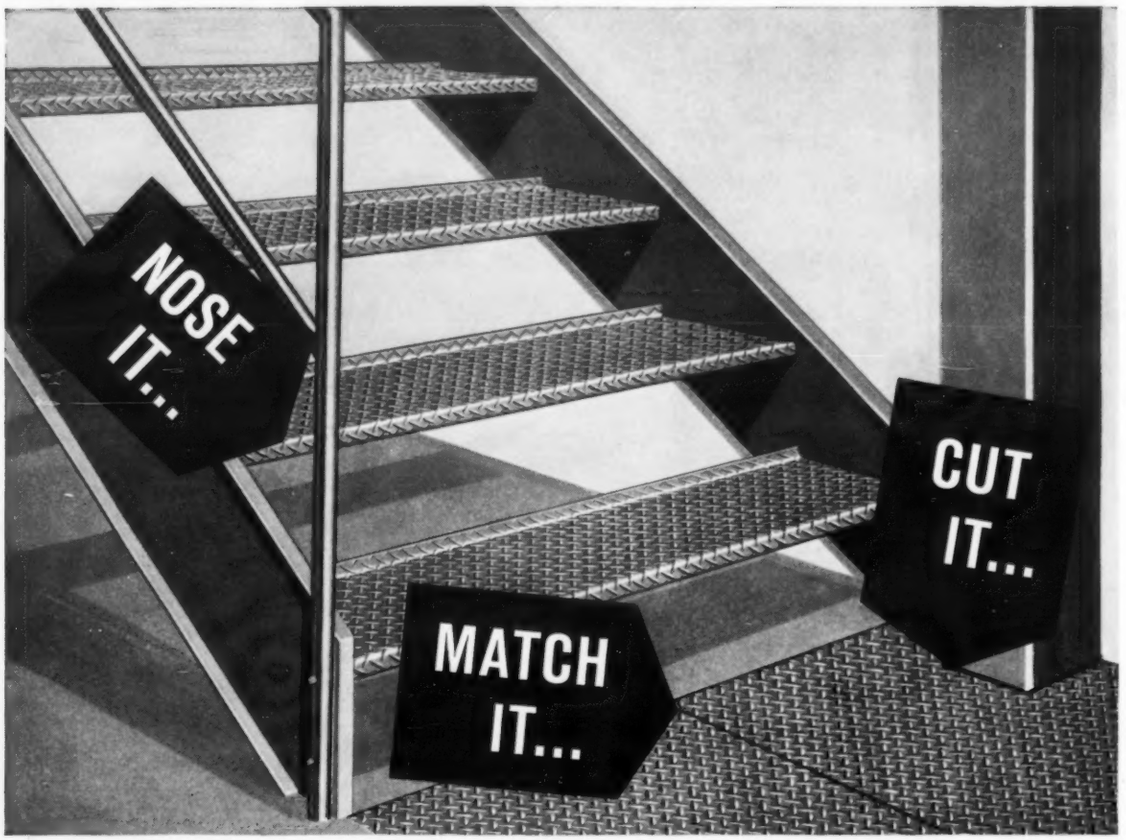

Alan Wood Super Diamond floor plate ...is easy to fabricate

Here's a heavy duty floor plate that can be sheared, formed, welded, and easily matched. The arrangement of the unique A.W. Super Diamond pattern allows you to bend it at any place.

A. W. Super Diamond will last for years ... provides a safe, non-skid footing at all times. Easy to clean? A. W. Super Diamond can be swept, hosed or mopped easily . . . from any angle.

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Circle 67 on Reader-Service Card for more information

Circle 66 for more information on Cutler-Hammer Products shown inside

Personnel Noise Protector 347

Featuring easily replaceable cushions and crown pads of polyvinylchloride, these 12-oz noise protectors are said to provide better noise reflection than many styles having more bulky ear cavities. The "Quiet Ear" cups of gray impact-resistant plastic are attached to an easily adjustable headband, assuring worker comfort when the protector is worn over long periods of time, even if used with hard hats and safety eyewear. Changes in design and an increase in market volume are said to allow considerable price reduction from earlier models.

Bausch & Lomb Inc., Safety Products Dept., Rochester 2, N.Y.

Low-Frequency Noise Generator 348

A grid-controlled gas thyratron in a transverse magnetic field serves as the primary source of noise in this generator. The noise output is stabilized against a reference voltage and filtered by a precision network. Further amplification, phase detection and low-frequency filtering result in an accurately controlled noise voltage whose spectral density is constant over a specified frequency band and whose amplitude probability distribution is gaussian. The Model 301A produces white noise for frequencies below 40 cps at up to 15v rms into a 1-megohm resistance. Dynamic range of 5:1 peak-to-rms value is provided. The noise generator may be used as a general-purpose laboratory instrument or in conjunction with an analog computer.

Elgenco Inc., 1555 Fourteenth St., Santa Monica, Calif.

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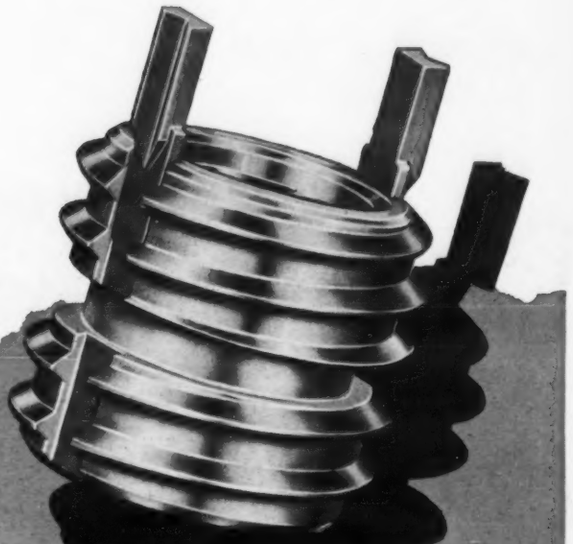

...and THESE standard inserts DO NOT require special taps, drills, or gages for installation

KN, KNL, KNH, KNHL Series Qualify to NASC STANDARDS

KEENSERTS® ...the ONE-PIECE inserts that are installed with STANDARD taps, drills, and gages now offer you a full line of inserts and studs to meet your every need

IN STOCK .... Light Weight—Miniatures—High Strength Heavy Duty—Internal Thread Locking or Regular—Full Floating Styles, Too!

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Light weight inserts

KNL
Light weight inserts, with internal thread lock

KNH
Heavy duty inserts

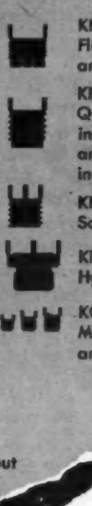
KNHL
Heavy duty inserts, with internal thread lock

KNHXH
Extra heavy duty inserts

KNHXHL
Extra heavy duty inserts, with internal thread lock

KNB & KNBL
Blind end inserts, with and without internal thread lock

KNHB & KNHBL
Blind inserts, with and without internal thread lock



KNK & KNKL
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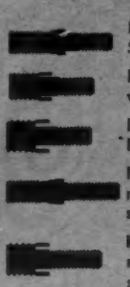
Quickly-replaceable thread inserts, with free-spinning and prevailing torque type internal thread locks

KNJ
Solid inserts

KNY
Hydraulic inserts

KC & KCL
Miniature inserts, both regular and internal thread locking



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High-Lubricity Coatings Ease Valve Operation, Reduce Maintenance

E. J. Stefanides, Central States Editor

A thin coating of dry-film lubricant is permanently bonded to the plugs of a new line of tapered-plug industrial valves. The extremely low coefficient of friction of the high-lubricity coating material and the permanent separation of base metal which it provides result in increased operating ease and decreased valve maintenance.

Primary objective in design of the new line was to provide a series of valves which would reduce the maintenance function to a minimum. To achieve this end, an intensive research and development was undertaken.

The most important aspect of this program was the search for a suitable coating material that would provide inherent lubricity and prolonged ease of valve operation. From this program, in which dozens of coating materials were evaluated, two materials—a plastic polyfluoride ("Teflon") and a molybdenum-disulfide material—finally were selected. Of more than 40 test materials, these were found to be the most effective in reducing and maintaining operating torque at low levels. Both presently are used in the valve line.

The "Teflon" coating is used in valves which operate under conditions below 1000 psi in a wide variety of fluid control services. A soft, amorphous material, it is almost completely inert chemically and has the lowest coefficient of friction of any coating material when applied in the proper thickness.

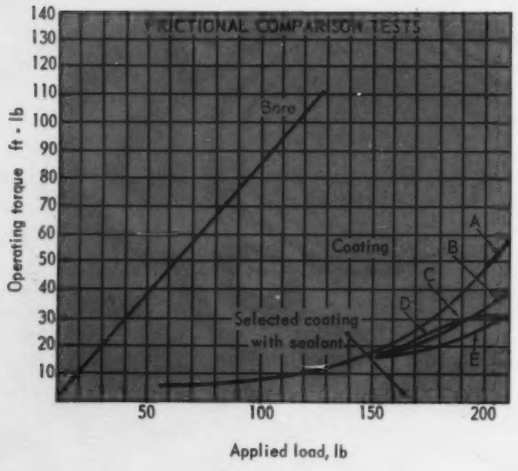
"Teflon" coating is applied in aqueous solution by an automatic spray set-up in a film thickness on the order of 0.0005 inch. This thickness facilitates dissipation of frictional heat and reduces effects of thermal expansion. This thickness also minimizes creep or cold flow by the anvil effect of underlying materials.

The molybdenum-disulfide coating is applied in the same way. A laminar solid, it is used for valves intended for high-pressure service (up to 10,000 psi). It is also relatively inert chemically and in tests has withstood attack from air, chlorine gas, molten sulfur and other reagents.

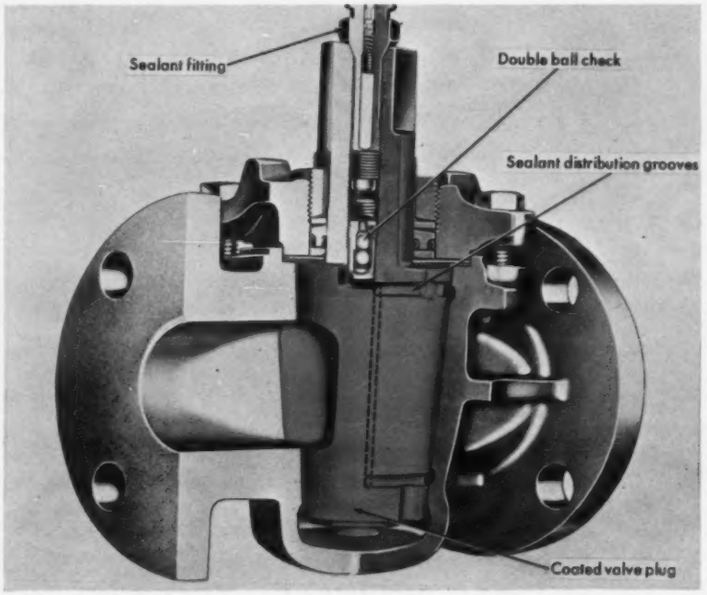
Both these coatings were subjected to field tests before adoption. All in all, these tests involved more than 10,000 valves in a variety of field services.

Other new features incorporated in the valves are intended primarily to further reduce operating torque and to provide for more efficient injection of valve sealant. They were adopted because of test results which showed that the sealant enhanced the operation of the valves even with the coating, particularly in applications where drop-tight shut-off is required.

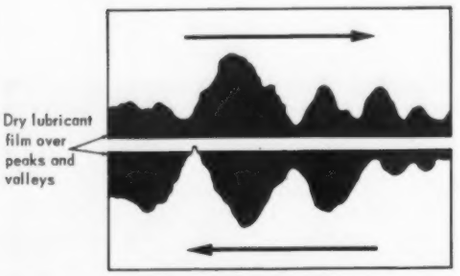
This line of valves is designed and manufactured by the Rockwell Mfg. Co., Pittsburgh, Pa., and is marketed under the registered trademark name "Permaturn".



CURVES show comparison of frictional forces required to operate coated and uncoated valves with and without the addition of sealant. In tests, applied loads were increased in uniform increments and build-up of operating torque noted over approximate maximum of 3000 cycles. All coatings substantially reduced operating torque requirements. Conventional valve sealant reduced torque levels even further.



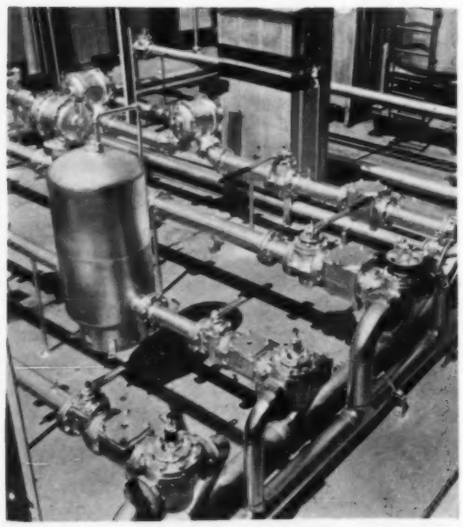
VALVE cross-section shows how valve plug is coated with dry-film lubricant material after lapping of the plug. Button fitting at top of stem, double-ball check arrangement and plug grooves provide for injection and utilization of sealant. This arrangement allows sealant to be injected without disassembling valve. Sealant improves seating and provides further decrease in operating torque.



HIGHLY MAGNIFIED VIEW of coated lapped metal surface shows how dry-film coatings provide thin, readily sheared boundary layer between two facing surfaces of harder metal. Operating speed is important factor in boundary lubrication. Lower operating speeds have increased tendency to break through lubricant film under bearing loads.

Conditions	Valve No. 1 (standard)	Valve No. 2 (coated plug)
1 - Initial adjustment, 70F	40 lb - ft	30 lb - ft
2 - 300 psi equal pressure	15	5
3 - 300 psi ΔP	50	5
4 - After 10 cycles @ 300 psi ΔP	75	5
5 - After relubrication, 300 psi ΔP	75	5
6 - ΔT 600 psi ΔP	130	5
7 - After 20 cycles @ 600 psi	-	5
	Summary	
	Total number cycles: 15. Test stopped so that valve would not gall. Valve had dry, "grabby" feel throughout test. No leaks.	Total number cycles: 50. Valve had smooth, even feel throughout test. No leaks.

REDUCTION OF OPERATING EFFORT IN HIGH-TEMPERATURE TESTS. Valve tested was 2-inch nominal size; special sealant was used, and test temperature was 350F.



VALVES are made in two designs—standard with upright plug for low-pressure applications and inverted plug design for high-pressure applications.

FLANGE PROJECTIONS improve TORQUE RETENTION

Here's a simple, economical, and widely adaptable way to build elasticity into rigid flange-bolt assemblies . . . and get better torque retention.

E. M. SMOLEY, Research Physicist, Armstrong Research and Development Center

To minimize loss of bolt torque in rigid gasketed joints, design engineers try to introduce some elasticity into the flange-bolt system.

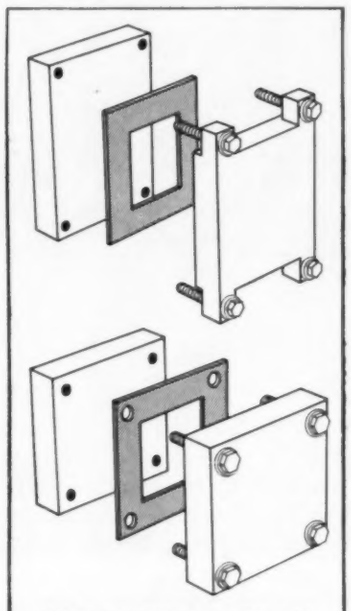


Figure 1-a (Top): Test flange with gasket. Note cantilevered projections for bolt holes. Flanges 1" thick, with gasket area 4" square.

Figure 1-b (Bottom): Control flange with gasket area 4" square.

One way to do this is to use the longest bolts possible, torqued close to their recommended limits. The elasticity of the bolts (the so-called "spring effect") then acts to compensate for compression drift and the effects of thermal expansion.

In most applications, however, long bolts are either impractical or uneconomical. As alternates, designers may use spring-loaded bolts or through bolts with nuts. These will usually produce the desired elasticity, but they increase parts costs and add to assembly time.

Armstrong research engineers suggest the use of cantilevered projections as a simple, economical, and widely adaptable way of building elasticity into a rigid flange.

Figure 1-a shows a laboratory design of such a flange. The machined projections through which the bolts pass do not contact the bottom flange. As the bolts are tightened, the projections deflect slightly, introducing elasticity through the flange instead of through the bolts.

This design was tested extensively at the Armstrong Research and Development Center. A control flange of identical size except for the projections was tested simultaneously (Figure 1-b).

Both flanges were gasketed with an Armstrong Accopac® asbestos material (1/32") and assembled with four 5/16" NF bolts. In the initial test, all bolts were torqued to 5 pound-feet, and both assemblies were placed in a 300° F. oven.

After 18 hours, retained torque was measured (1) while the flanges were still hot; and (2) when they had cooled to room temperature.

The test was repeated, increasing the torque in increments of 5 pound-feet up to 25 pound-feet. A summary of the test data is given in Figure 2.

TORQUE RETENTION

POUND FEET INITIAL TORQUE	HOT TORQUE CONTROL	HOT TORQUE TEST	COLD TORQUE CONTROL	COLD TORQUE TEST
5	3.6	4.5	3.0	3.6
10	6.4	9.8	6.2	8.9
15	10.0	14.4	10.0	14.0
20	14.8	20.2	13.2	19.6
25	18.2	25.6	18.2	24.8

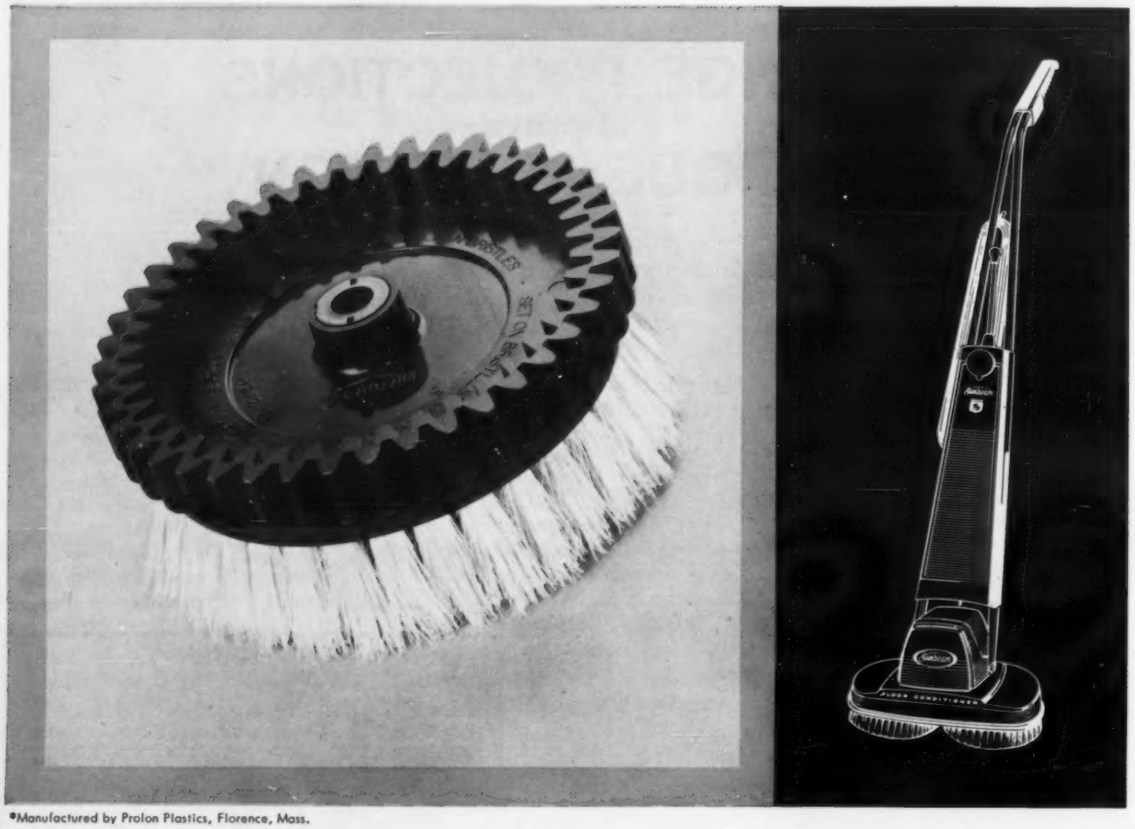
Figure 2: Results of flange projection study. Hot torque measured after 18 hours at 300° F. Cold torque measured after cooling to room temperature. Accopac AN-890 asbestos gasket (1/32") in flanges.

In every case, the test flange shows a higher torque retention—hot or cold—than the control flange. At loads of 15, 20, and 25 pound-feet, practically 100% of the initial torque load was retained on the test flange.

Research on problems of gasket selection, design, and performance is a continuing project at the Armstrong Research and Development Center. Our large library of data may already contain answers to your specific sealing problems. We will be glad to make suggestions if you will send details to us. Armstrong Cork Company, 7112 Ithaca Street, Lancaster, Pa.

Armstrong GASKET MATERIALS

Naugatuck KRALASTIC
THE ORIGINAL ABS RESIN



*Manufactured by Prolon Plastics, Florence, Mass.

Cleans up against materials costing twice as much

Sunbeam Corporation ran exhaustive tests to choose a bristle-head* for the brushes in its new floor cleaner-waxer. Kralastic® MM excelled...outperformed products costing twice as much. Let's see why...

The cleaner-waxer has two brushes: one is driven by a pinion through its internal gear and, in turn, drives the other through its external gear. Here's where Kralastic made the difference. Kralastic's superior dimensional stability and toughness insure constant transmission of power, its self-lubricating properties cut friction, its abrasion resistance minimizes wear from gritty floor-cleaning compounds.

Kralastic takes high-speed punishment, absorbs jarring impacts. What's more, water and cleaning compounds can't damage Kralastic. It won't rust, resists chemical attack. And lightweight Kralastic parts can be injection molded...need no finishing...are interchangeable.

Learn more about Kralastic, the hard, tough plastic material that has proved itself in applications from 16,000 miles of underground pipe to automotive instrument clusters. Call or write us:

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Eccentric Moves Ceramic Magnet to Operate Lifting Magnet

Edward W. Schrader, Western Editor

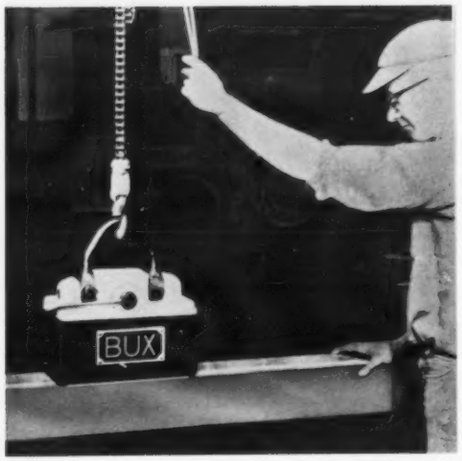
A 3000-lb load now may be lifted with permanent magnets, thus offering users a lifting magnet which does not require associated batteries or electrical equipment. Ceramic magnets, often used in table chucks, make the device possible.

The magnetic field of the ceramic magnet is conducted through magnetic steel pole pieces directly to the bottom of the housing of the lifting magnet. The lifting magnet is activated "on" or "off" by rotating a handle. The handle operates an eccentric which slides a pack of steel pole pieces and ceramic magnets so that the poles either augment each other in the "on" position or cancel each other in the "off" position.

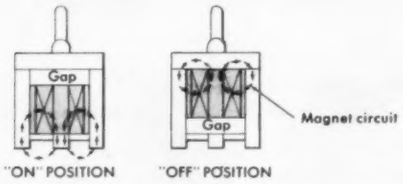
In the "on" position, a large air gap exists between the pack and the return path in the top of the housing. The magnetic path for lifting is through the work piece to be lifted. In the "off" position the gap is at the bottom of the unit between the stainless-steel face plates and the pack. The magnetic path then exists between the pack and the housing.

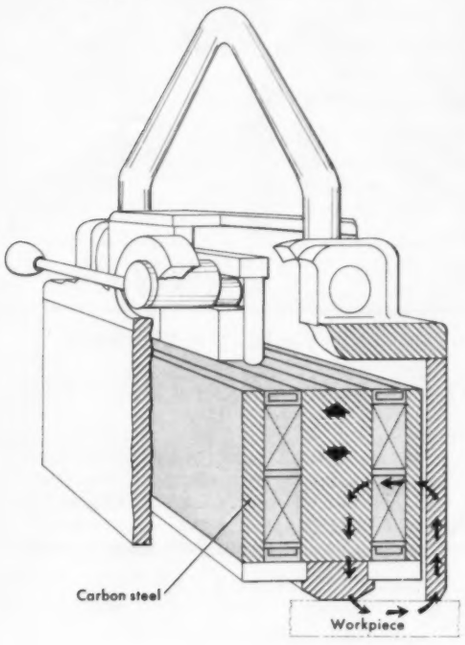
The lifting magnet is a design of Bux Magnetic Products, Inc., San Jose, Calif., Subsidiary of O. S. Walker Co., Inc., Worcester, Mass.

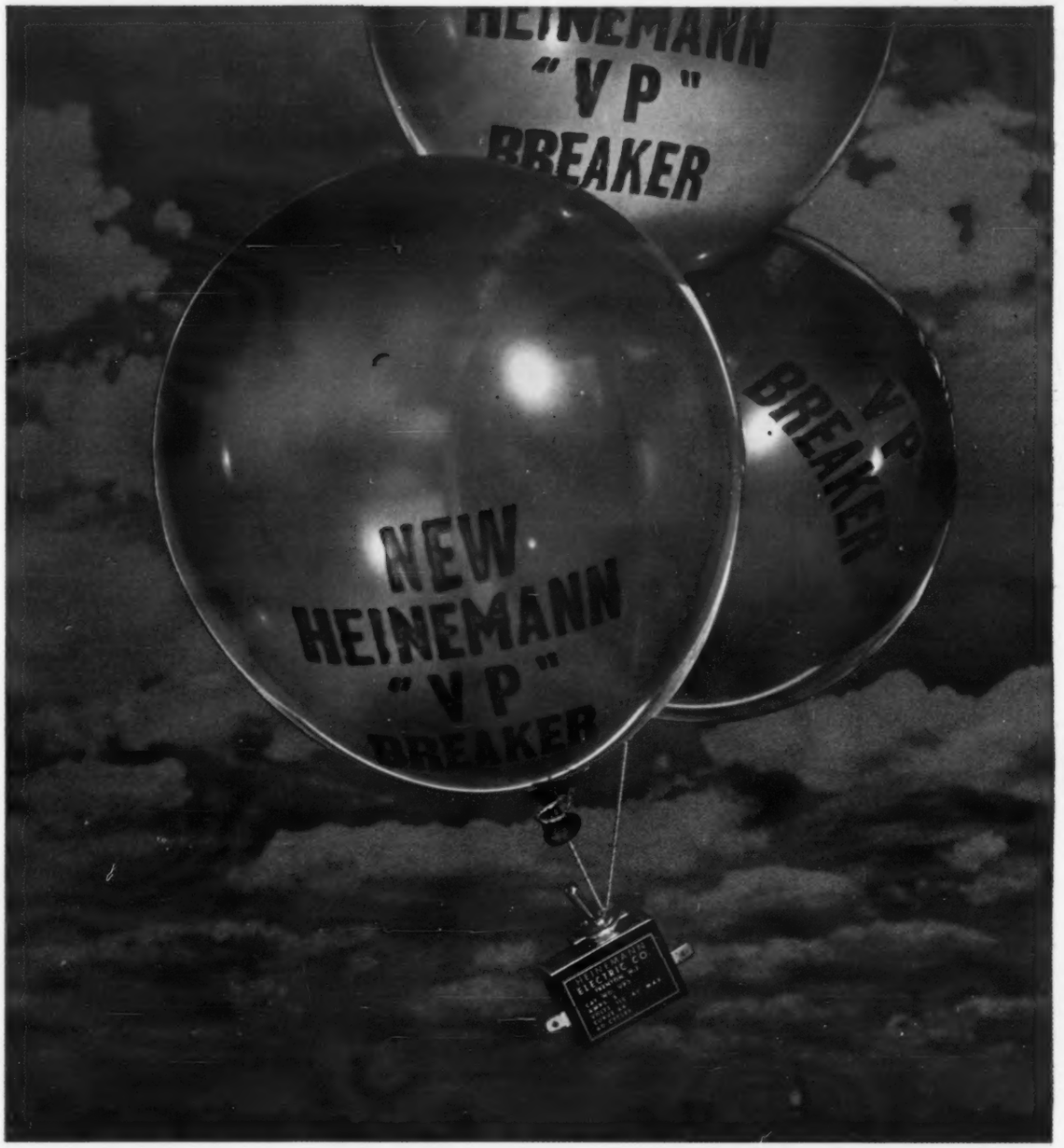
MANUALLY OPERATED ECCENTRIC produces combined sliding and vertical motion of permanent-magnet pack. Sliding motion is necessary to disengage workpiece. Vertical motion of pack shifts air gap from top of pack to bottom of pack.



LIFTING MAGNET actuated by permanent magnet may be used with any hoisting system. It eliminates necessity of auxiliary power supplies for activating magnet. For full carrying power of permanent magnet, steel or iron work piece must be free of scale, rust or other nonpermeable materials.







Only 1-1/2 ounces (including the switch plate)

Heinemann's new Series VP may well be the lightest circuit breaker made. For sure, it's one of the smallest and most compact you'll find around. Yet, remarkably, it's capable of handling all the functions of much larger Heinemann breakers.

It is temperature-stable. Current rating and calibrated trip-points are completely unaffected by ambient temperature. No derating . . . ever.

It is available with a choice of time relays. You can have either a "fast" or "slow" delay. Or instantaneous response.

It can be furnished with any of Heinemann's special-function internal circuits. With a little ingenuity and a special circuit, you can make the breaker do such out-of-the-ordinary chores as remote switching, circuit "slaving," alarm signaling.

The matchbox-size Series VP is available in any integral or fractional rating you might need, from 0.050 to 15 amps (at 110V, 60 or 400 cycles AC, or 50V DC).

Bulletin VP will give you detailed specifications and dimensions. A copy is yours for the asking.

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SA 2455

Circle 70 on Reader-Service Card for more information

DESIGN DATA NEWS

Critical Axial Buckling Load on Columns

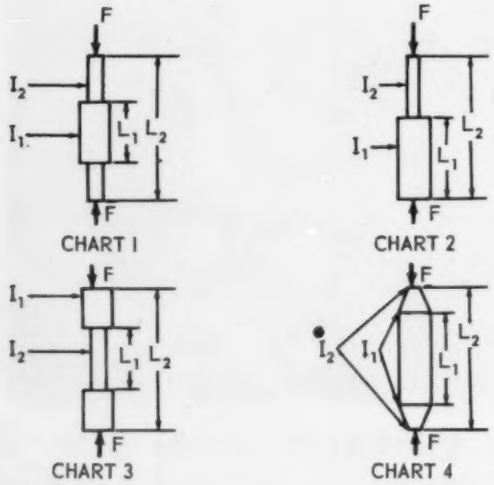
With Variable Cross-Section

Richard Wadler, Mechanical Engineer,
Raytheon Co., Bedford, Mass.

If a long column (in the "Euler" range) is subjected to axial loads, the stability can be increased by varying the cross-sectional area. The nomogram is based on the equation

$$F_{CR} = mEI_2/L_2^2$$

Where: F_{CR} = critical axial load, lb
m = a factor which depends upon the ratios I_2/I_1 and L_1/L_2 (Charts 1-4)
E = modulus of elasticity, psi
I_2 = moment of inertia of the smaller cross-section, inches⁴
L_2 = overall length of the column, inches



Example 1: Determine the critical axial load on a *steel* column, with hinged ends (Chart 1), if $L_1 = 30$ inches, $L_2 = 60$ inches, $I_1 = 10$ inches⁴ and $I_2 = 3$ inches⁴.

Solution: $L_1/L_2 = 30/60 = 0.5$ and $I_2/I_1 = 3/10 = 0.3$. From Chart 1, $m = 6.75$. Using nomogram, align $m = 6.75$ with $I_2 = 3$, intersecting the Reference line. Align this intersection with $L_2 = 60$ and read $F_{CR} \cong 170{,}000$ lb.

(Text continued on page 78)

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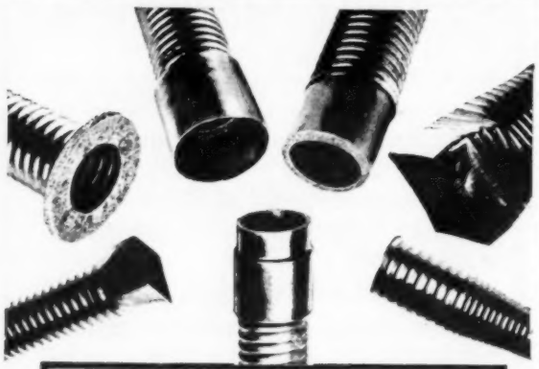

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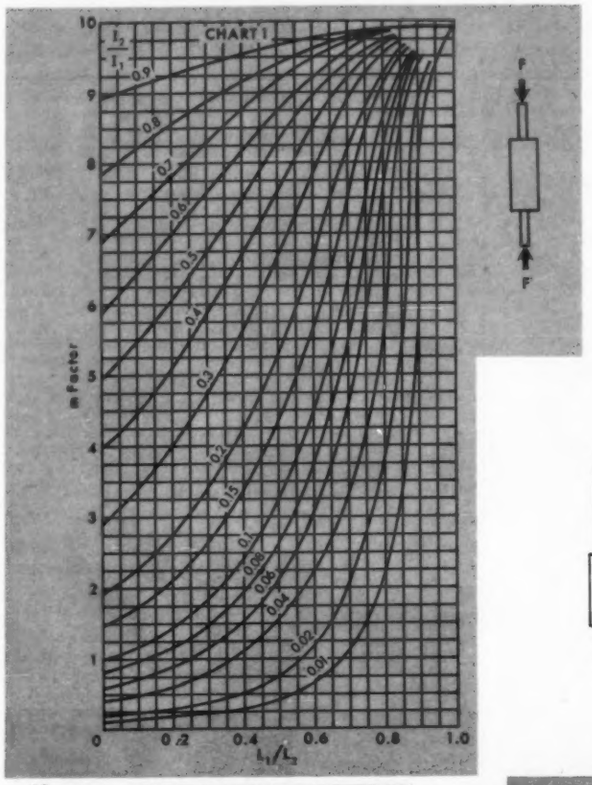
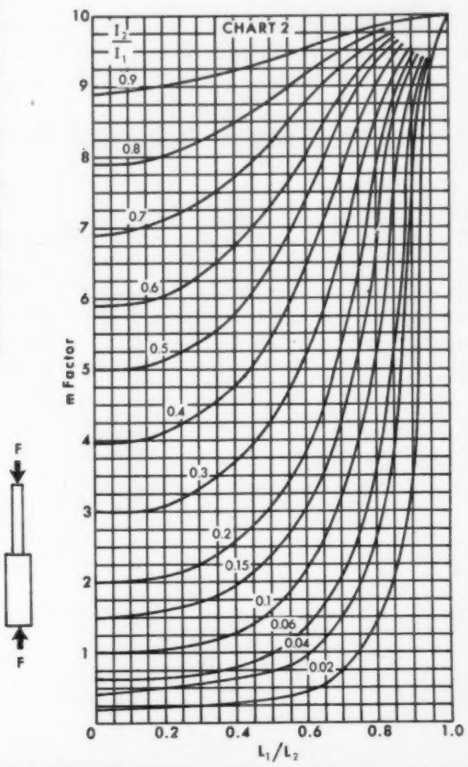
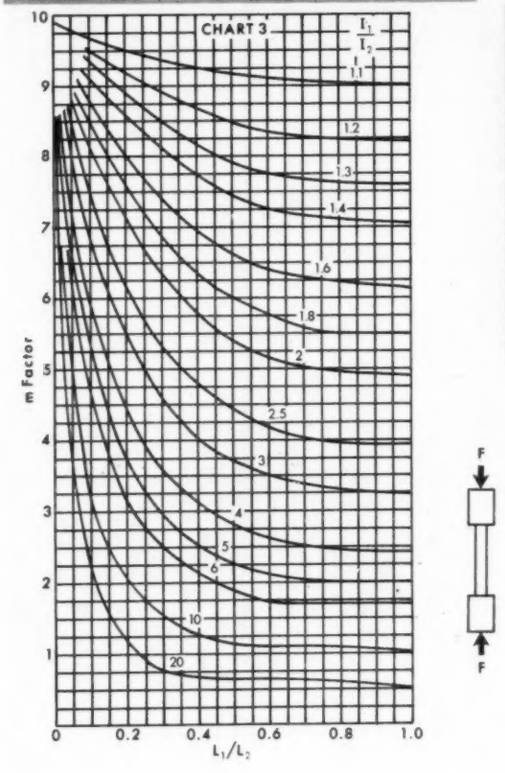
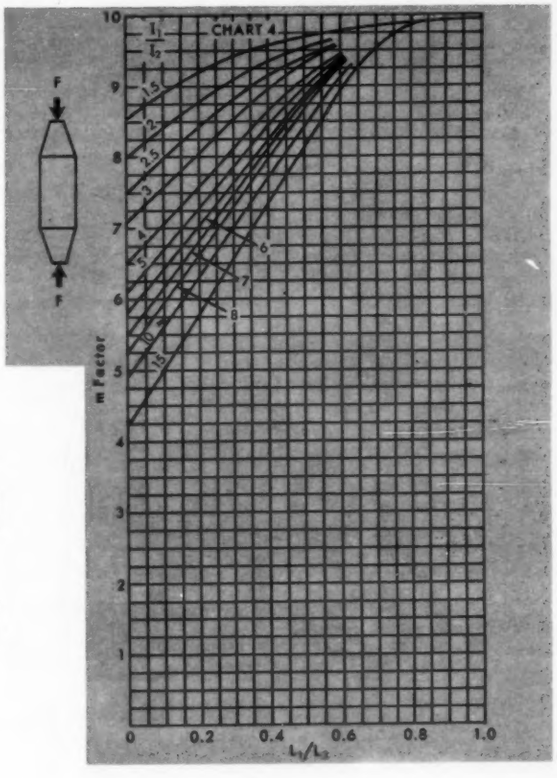




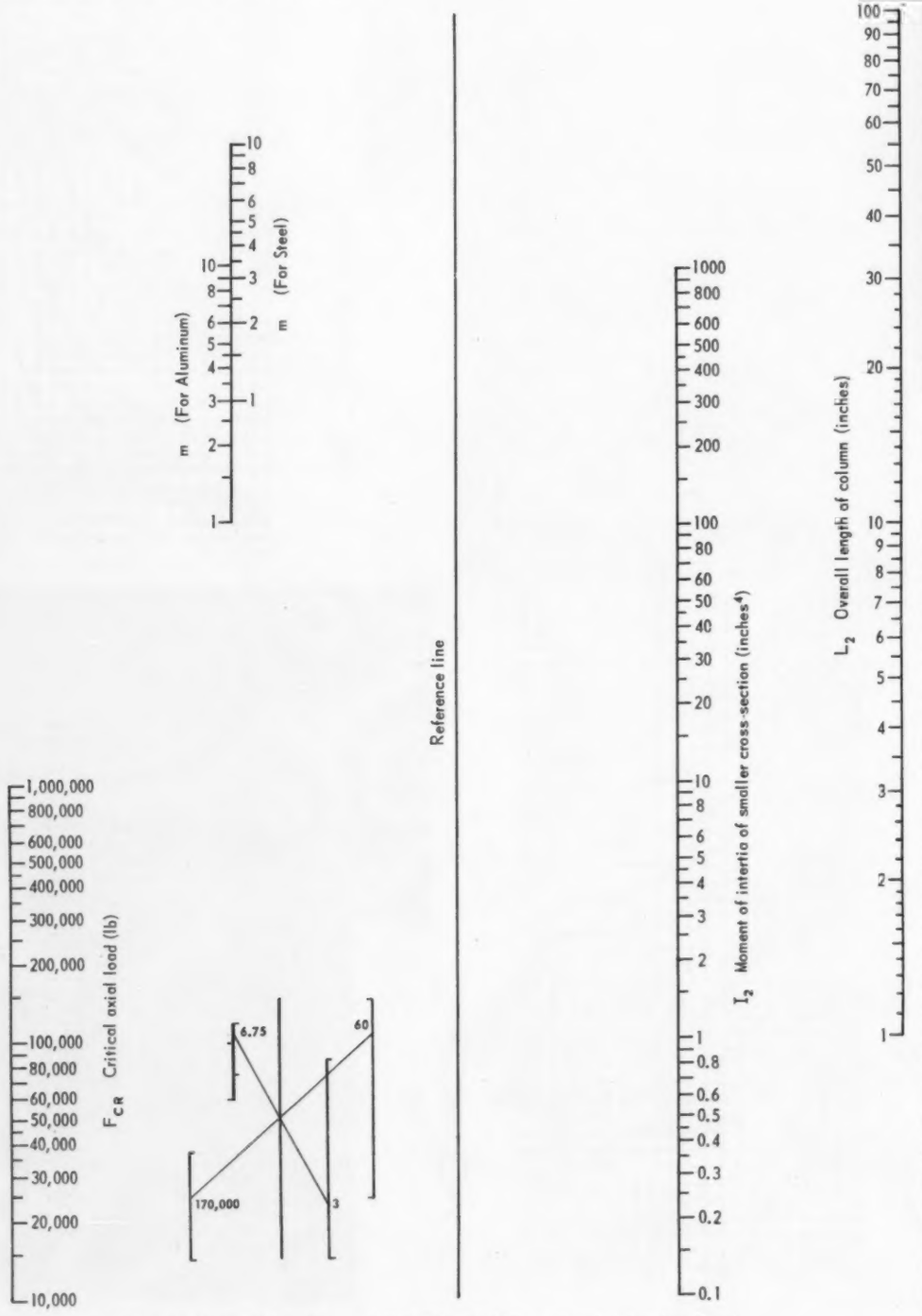




Critical Axial Buckling Load on Columns . . . *Cont.*

Example 2: Determine the critical axial load on an *aluminum* column, with hinged ends (Chart 2) if $L_1 = 28$ inches, $L_2 = 40$ inches, $I_1 = 20$ inches^4 and $I_2 = 2$ inches^4.

Solution: $L_1/L_2 = 28/40 = 0.7$ and $I_2/I_1 = 2/20 = 0.1$. From Chart 2, m = 3.25. Using nomogram, align m = 3.25 with $I_2 = 2$, intersecting the Reference line. Align this intersection with $L_2 = 40$ and read $F_{CR} \cong 41{,}000$ lb.



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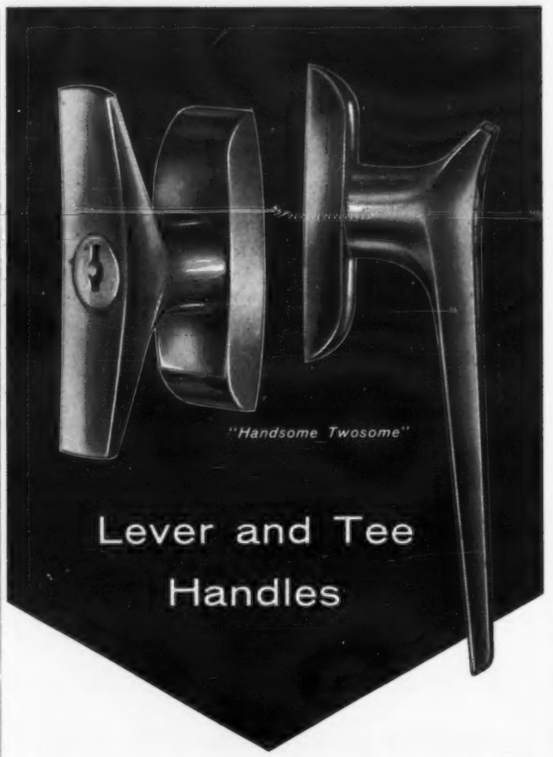

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Indeterminate Fixed Beam—Allowable Reaction

S. Warren Kaye, Peabody, Mass.

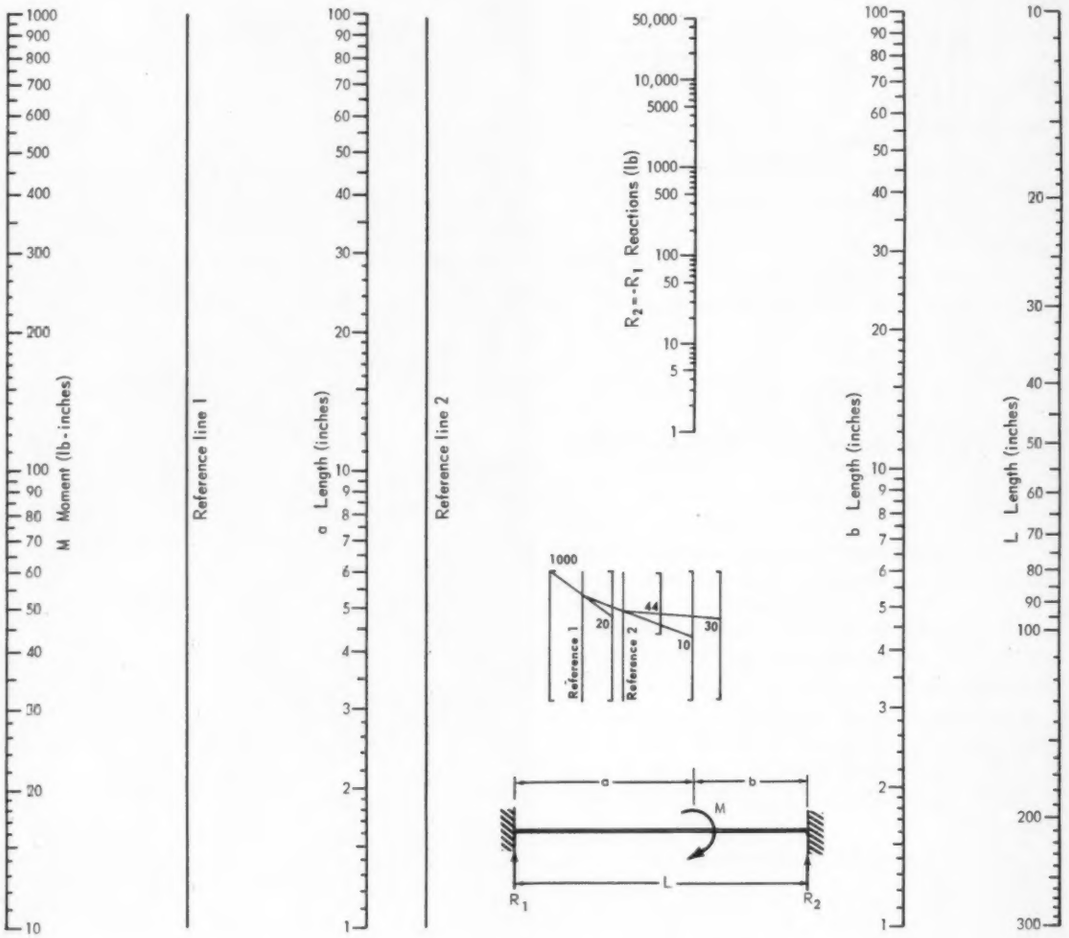
The nomogram solves

$$R_2 = -R_1 = 6Mab/L^3$$

for a beam fixed at both ends with a moment applied at any point, where R_2 and R_1 are in lb, a, b and L are in inches, and M, applied moment, is in lb-inches.

Example: Find the reactions for an indeterminate fixed beam where L = 30 inches, a = 20 inches, b = 10 inches and M = 1000 lb-inches.

Solution: Align M = 1000 with a = 20, intersecting Reference line 1. Align this intersection with b = 10, intersecting Reference line 2. Align this intersection with L = 30 and read $R_2 = -R_1 = 44$ lb.



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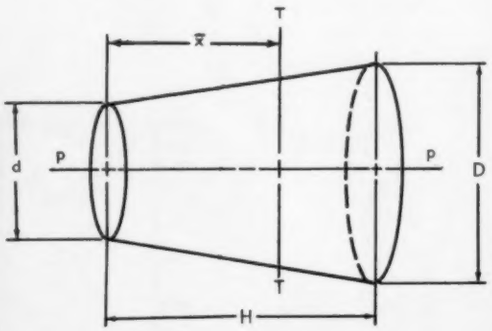
Volume and Inertias of the Cone Frustum

S. Kravitz, Dover, N. J.

To calculate volume, center of gravity and moments of inertia of the frustum of a right circular cone, first calculate these properties for a cylinder of the same height and of average diameter ($D_{AV} = (D+d)/2$), then multiply by the correction factors given in Graph 1. Applicable equations are:

$$V = (\pi D_{AV}^2 H/4)(K_V)$$
$$\bar{x} = (H/2)(K_C)$$
$$I_p = (VD_{AV}^2/8)(K_p)$$
$$I_T = (VH^2/12)(K_T) + (I_p/2)$$



Where:

- D = diameter of larger base
- d = diameter of smaller base
- D_{AV} = $(D+d)/2$
- C = d/D
- H = height of the cone frustum
- V = volume
- $\bar{x}$ = center of gravity (from smaller base)
- I_p = polar moment of inertia
- I_T = transverse moment of inertia about an axis passing through the center of gravity, perpendicular to cone axis.
- K_V, K_C, K_p and K_T = correction factors as functions of $C = d/D$.

Example: If $D = 2$, $d = 1$ and $H = 3$, determine V, $\bar{x}$, I_p and I_T.

Solution: $D_{AV} = (2+1)/2 = 1.5$ and $C = d/D = 0.5$. From graph, $K_V = 1.04$, $K_C = 1.215$, $K_p = 1.18$ and $K_T = 0.89$.

Then:

$$V = [\pi(1.5^2)(3)/4](1.04) = 5.51$$
$$\bar{x} = (3/2)(1.215) = 1.82$$
$$I_p = [5.51(1.5^2)/8](1.18) = 1.83$$
$$I_T = [5.51(3^2)/12](0.89) + (1.83)/(2) = 4.59$$

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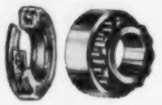

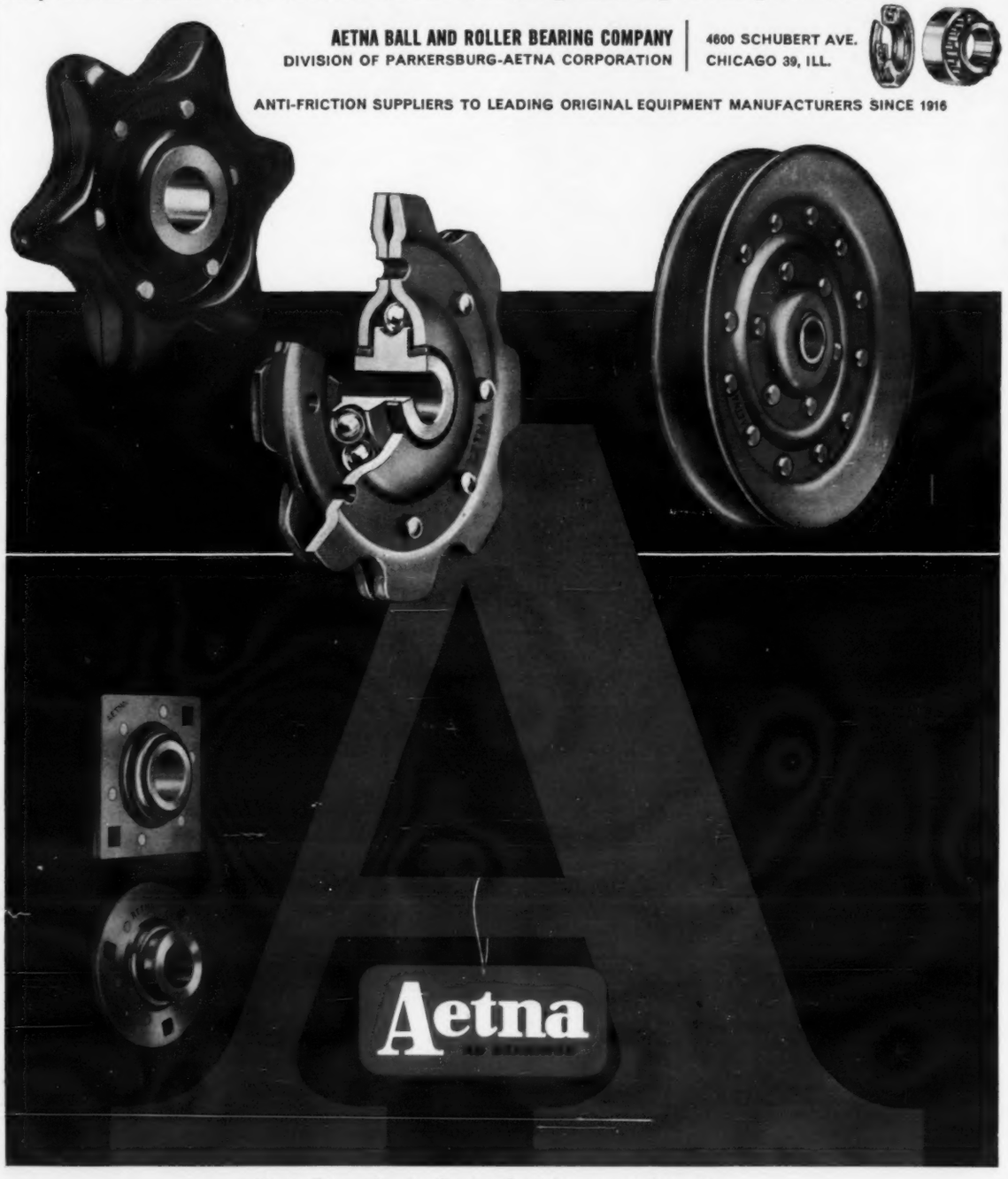

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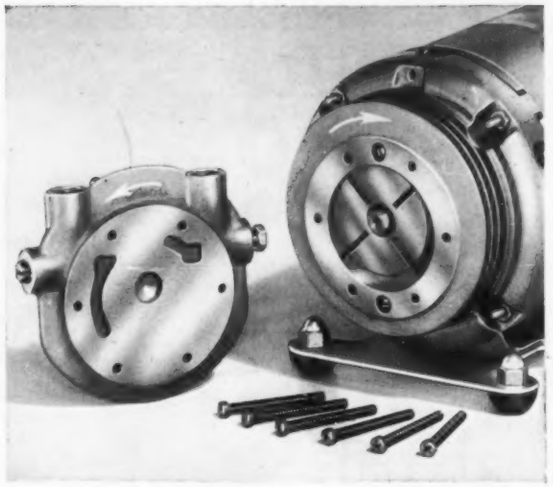

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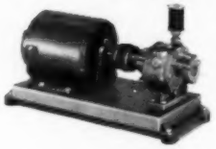

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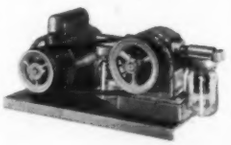

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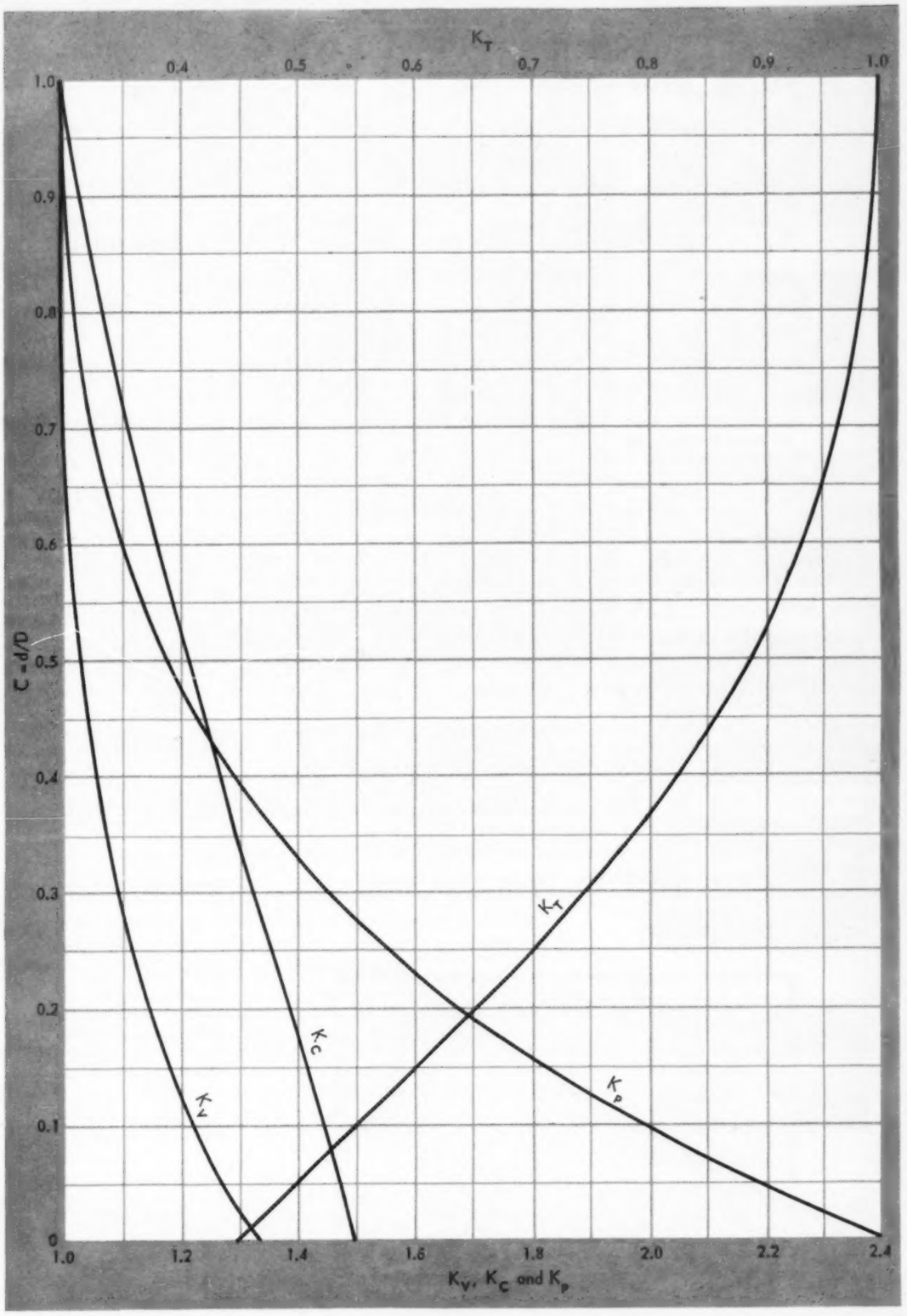

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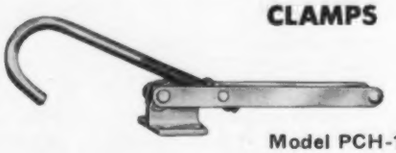

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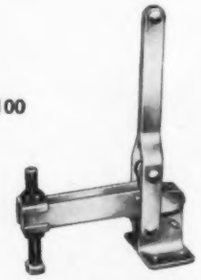

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Portable Two-Way Radio 451

Fold-out Form ECR-942 describes the "Voice Commander" portable two-way radio. The 1w unit, designed with transmitter and receiver in a single case, is illustrated in actual size and its many applications are cited. Features of the lightweight, VHF-FM two-way radio are detailed. General Electric Co., Communication Products Dept., Lynchburg, Va.

Epoxy Resins Comparison 452

Comparison of 17 "Randac" epoxy resins, their components, primary uses, handling characteristics, and physical and electrical properties is presented in a fold-out chart. A handy business-reply card is furnished with the chart for additional information on the resins. Mitchell Rand Mfg. Corp., 51 Murray St., New York 7, N.Y.

Nonferrous Alloys 453

This master chart describes 40 nonferrous alloys most frequently specified for centrifugal castings. Aluminum bronze, gear bronze, bearing bronze, manganese bronze, nickel, silver and special alloys are covered and nominal chemical compositions are given for each. Bulletin 100 shows more than 100 similar governmental and society specifications as well as calculations for Brinell hardness, elongation, tensile and yield strength. Wisconsin Centrifugal Foundry, 905 E. St. Paul Ave., Waukesha, Wis.

Microwave-Diode Product Guide 454

Electrical characteristics and performance ratings for a line of microwave mixer, detector, varactor, tunnel and switching diodes are given in a 26-page product guide. Featured are a four-page replacement guide insert and a complete listing of mechanical and environmental test procedures. More than six pages of microwave-diode application notes include a noise-figure nomogram and a nomogram for calculation of series resistance of varactor diodes. Sylvania Electric Products, Inc., 100 Sylvan Rd., Woburn, Mass.

Electrical Tape Samples 455

This selection chart contains actual samples of 15 different insulating tapes. Chart DB-70A gives physical and electrical data on each of the tapes, which include paper, polyester film, glass cloth, acetate cloth, acetate film and vinyl film insulations. Information provided includes insulation class, tensile strength, elongation, thickness, dielectric breakdown point, electrical resistance and type of adhesive and adhesion. Johns-Manville, Dutch Brand Div., 22 E. 40th St., New York 16, N.Y.

TV Picture-Tube Replacement Guide 456

This revised 24- by 30-inch wall chart contains essential characteristics of 460 types of television picture tubes, ranging in size from 2- to 30-inch faceplates. The replacement guide, No. ETR 702-F, gives heater voltage and current, type of construction and faceplate, deflection angle, anode contact, external coating, type of focus, dimensions, pin connections and typical operating conditions of the essential elements for each tube. General Electric Co., Electronic Components Div., Owensboro, Ky.

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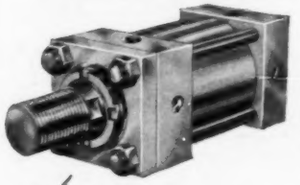

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Equipment Manual **458**

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Power Supplies **459**

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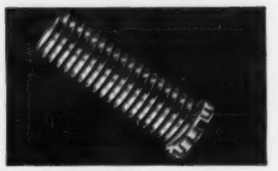

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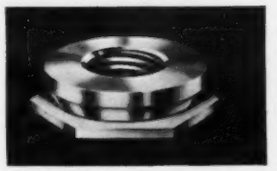

SELF-CLINCHING FLUSH FASTENER

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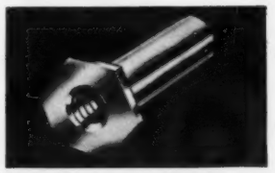
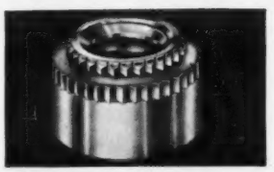


SELF-CLINCHING STAND-OFF



SELF-CLINCHING SPLINE FASTENER

PENN ENGINEERING & MANUFACTURING CORP.

DOYLESTOWN • PENNSYLVANIA

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INDIANAPOLIS—CLIFFORD 1-4020
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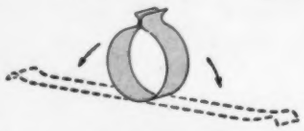
the NEG'ATOR Data Book

HUNTER Science in Springs

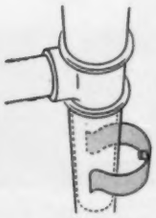
4. CLIPS, CLAMPS AND TUBES

Using NEG'ATOR bands to fasten, retain, or clamp

1. A NEG'ATOR is a band of spring steel which is so prestressed in manufacturing that it exhibits a powerful tendency to curl—uniform throughout its length.



2. A fractional turn, partial coil, single coil, or several coils can be used as strong, resilient clips. Clips like these can be opened completely —even straightened—and will always re-coil to the same curvature.

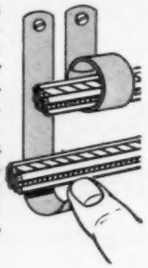


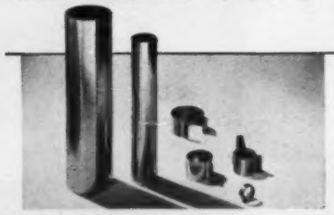
3. Again and again they can be opened wide and snapped into place without becoming "tired." And they can be furnished in various shapes and with special attachments.

4. The NEG'ATOR band can be "wrapped around" connecting members or joined parts where there is no access to ends. Once mounted, the clip holds snugly to the connected members.

5. When both ends of a NEG'ATOR band are allowed to form loops, the band becomes a powerful clamp wherein pressure exerted by the coils remains constant for any opening.

6. A simple NEG'ATOR band makes an excellent quick-acting loop or guide for cables, wires, or tubing in auto assemblies, wiring harnesses. Engagement or disengagement is fast, cable ends need not be accessible, and "give" is built into the clip.





7. Wide bands become tubes or drums of great strength and surface accuracy. They can be made tough or flimsy, bright or dark—can be printed and used as tapes or scrolls.

How to use them?

▪ Currently, NEG'ATOR clips, clamps, and tubes are being used as retainer rings, safety clips for explosive devices, protective shields, printed scrolls, recorder chart drums, electrical connector locks, scaffold locking clips, spool clips, cementing clamps, leaf springs, and in many other ways. Write for details on characteristics and applications.

The NEG'ATOR spring is a development of Hunter Spring Company.

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LITERATURE

Lead-Antimony Grid Communication Batteries **461**

Bulletin T-533, 16 pages, describes a standard line of lead-antimony grid communication batteries. Weights, cell dimensions, electrical characteristics, discharge curves and rack data are included. Advantages of the "Plasticell" batteries are listed and an exploded view shows each part of a "Plasticell" battery. C & D Batteries, Div. The Electric Autolite Co., Conshohocken, Pa.

Packing and Shipping Guide **462**

How to increase efficiency and cut costs of packing and shipping operations are described in a 16-page illustrated booklet. Entitled "20 Tested Methods to Improve Packing and Shipping Operations", the "idea" folder gives tips and suggestions for shippers and includes material on safety, savings, product protection, proper maintenance of equipment and lists, and new techniques in packing and shipping. Better Packages, Inc., Shelton, Conn.

Capacitors and Resistors **463**

A 56-page catalog includes many new types in addition to the company's established line of capacitors and resistors for industrial use. Catalog IDC-561 includes electrolytic, paper, metallized-paper, ceramic, mica and tantalum capacitors, with complete specifications and illustrations. Other products included are interference filters, plate assemblies, precision resistors, capacitor kits and test instruments. The data are set up for quick reference in all sections. Aerovox Corp., 740 Belleville Ave., New Bedford, Mass.

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Electromechanical Components **464**

A 140-page pocket-sized catalog features precision gears, magnetic clutches and brakes, differentials, couplings, gear heads, limit stops, bearings, electronic hardware and other electromechanical components. Bulletin No. 100 presents schematics of the units along with complete specifications and ordering information. Siamco, Div. of Tech-Ohm Electronics, Inc., 36-11 33rd St., Long Island City 6, N.Y.

Science, Math and Optical Equipment **465**

Contains 1001 items for production, laboratory work, engineering and quality control, and mathematical training aids. Catalog 621, 160 pages, is intended as a reference guide to equipment for industrial plants, research laboratories, product and design engineers, scientists and inventors. Among items included are measuring magnifiers, pocket comparators, illuminators, projection sets, microscopes, telescopes and photographic equipment. Edmund Scientific Co., Barrington, N.J.

Miniature Round and Solder Connectors **466**

Two bulletins present data on miniature connectors. Catalog BSB, 24 pages, on solder connectors, includes specifications, dimensional drawings, tables, shell styles and termination devices for nine shell sizes conforming to MIL-C-0026482A. Catalog BHB, 32 pages, on round connectors, gives the same information for eight shell sizes. Both catalogs contain master color charts with line drawings and photographs keyed to dimensions presented in tables. Burndy Corp., Norwalk, Conn.

Value Analysis Technique **467**

An organized four-step program to find new and different ways to accomplish a function at the lowest possible cost is outlined in a 12-page booklet. The difference between value analysis and value engineering is discussed and types of products and components on which the value analysis technique has proved successful are included. Sections give information on how value analysis works, a definition of the manufacturer's value analysis technique and 21 specific value-analysis case histories. Spaulding Fibre Co., Inc., 310 Wheeler St., Tonawanda, N.Y.

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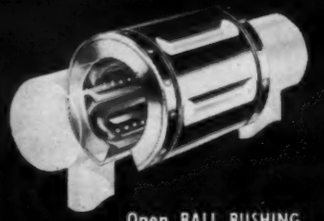

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ELIMINATE BINDING AND CHATTER
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PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS–A MAJOR IMPROVEMENT AT A MINOR COST

LITERATURE

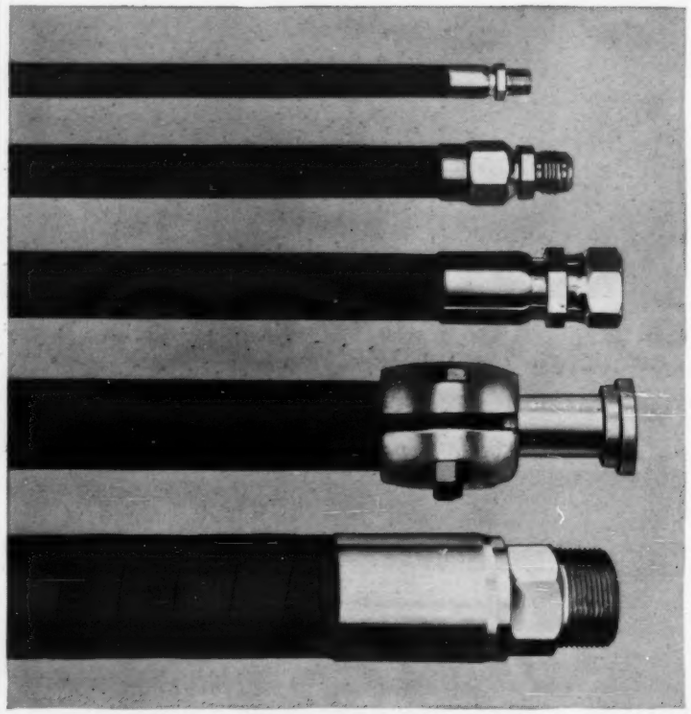
Hydroxyacetic Acid 468
This first technical bulletin ever published on hydroxyacetic (glycolic) acid covers uses, both established and potential, for this material. General properties, chemical reactions, storage and handling, handling precautions and toxicology information are given in this 24-page bulletin. E. I. du Pont de Nemours & Co., Room D-4147, Wilmington 98, Del.

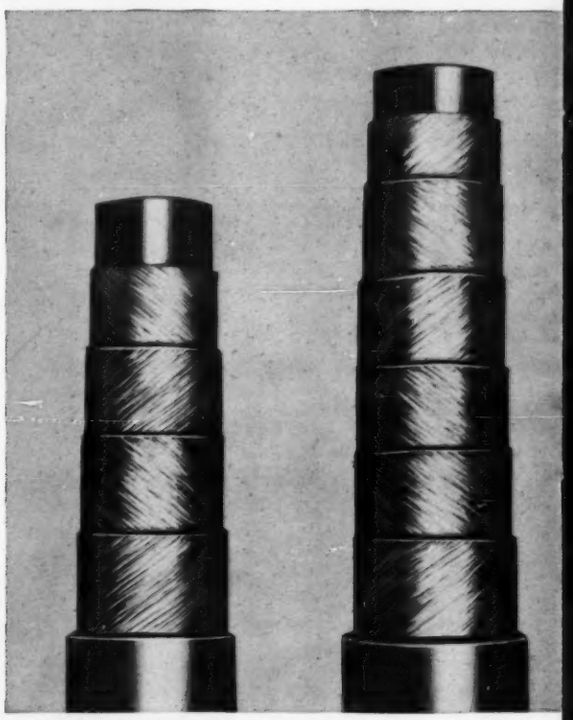
Education in Plastics 469
A discussion of the desirability of specialized training to prepare an engineering student for a career in plastics, this 12-page brochure also describes recommended courses to provide this training. Two of the six courses discussed are introductory, with the remaining four more highly specialized. Society of Plastics Engineers, 65 Prospect St., Stamford, Conn.

Mica Products 470
A reference file contains 13 product data bulletins describing a complete line of mica products, including heater plates, paper tapes, paper sheets and rolls, segments and commutator rings, segment plates, molding plates, fabricated parts and mica-fiber-glass tapes. One bulletin gives military specifications MIL-1-3505-C and MIL-1-21070A (ships) in tabular form. Another section of Brochure No. 27 discusses especially developed adhesives used in the manufacture of mica products. The Macallen Co., Inc., Newmarket, N.H.

Bearing Selection Data 471
Selection data on 143 standard and special miniature and instrument bearings are found on two-page engineering sheet M-3. Printed on heavy stock, the sheet covers 40 sizes, open and shielded, flanged and unflanged, including standard and narrow width types as well as extra-large OD bearings for synchros. Boundary, flange, land and undercut dimensions are given. Engineering information covers static and dynamic ratings, running torque values, lubricants, a nomenclature guide and tolerances. The Barden Corp., 200 Park Ave., Danbury, Conn.

WHAT'S NEW IN HYDRAULIC ASK....IMPERIAL-





NEW EXPANDED LINE

With the addition of new products, particularly in higher pressure hose assemblies, the Imperial-Eastman line offers more than you will find elsewhere. Here's a complete line of wire braid hose, as well as Imperial-Eastman's new Hytron polyamide-polyester hose. Medium-pressure hose assemblies now include 2-spiral wire and 1-wire braid. High and super-high assemblies are available to meet working pressures to 10,000 psi. Couplings, adapters, adapter unions, fittings—we have them to meet all your needs.

NEW HIGHER PRESSURE ASSEMBLIES

Working-pressure requirements going up for you? Then look for problem solutions at Imperial-Eastman. Hose assemblies are now available in the high- and ultra-high-pressure ranges—up to 10,000 psi. Again, the completeness of the Imperial-Eastman line and the engineered, tested quality offer advantages you won't find elsewhere. Among Imperial-Eastman's new products are spiral wire hoses in sizes from ¼ to 2 in.—to withstand working pressures up to 10,000 psi. Other types withstand working pressures over 3000 psi.

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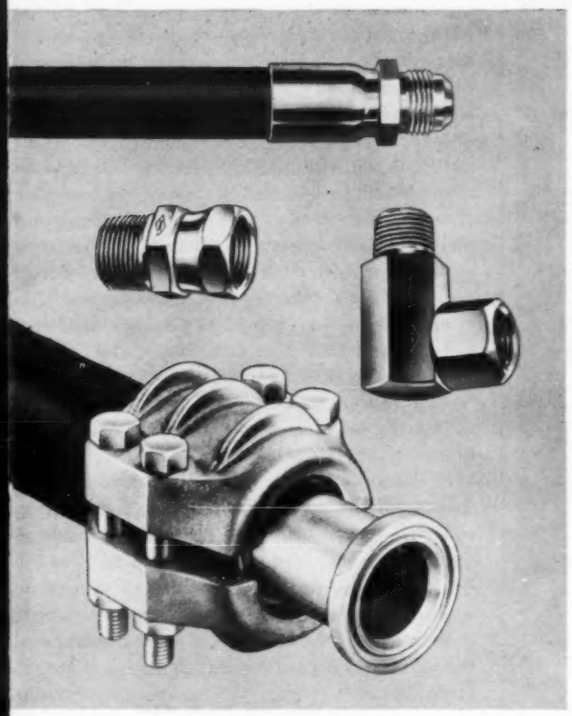
IMPERIAL

Imperial-Eastman Corporation General Offices:
Imperial-Eastman Corporation (Canada) Ltd., Barrie, Ontario

HOSE ASSEMBLIES?
EASTMAN

New ideas, new research, new products plus an expanded line of hydraulic hose assemblies—these are developments now coming from Imperial-Eastman. It's a complete line—includes low- to ultra-high-pressure assemblies to meet your expanding needs. As always, the line reflects highest engineering and manufacturing standards.



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You know that hose assemblies deliver best service with the proper application of couplings and fittings. From Imperial-Eastman you get matched quality in the complete assembly—with permanent or reusable couplings—and with adapters, adapter unions and other connectors. Now available is a new 4-bolt, clamp-type coupling which holds beyond hose burst pressure. Factory-assembled permanent couplings are applied by an exclusive Imperial-Eastman pressure-controlled process to assure absolute, matched-quality dependability.

NEW HYTRON® HOSE

This new polyamide-polyester hose solves many problems, meets many specifications as an alternative to one-wire braid SAE 100R1 hose. It has seven times the flex impulse life of wire braid, with comparable strength. Hytron hose also features excellent compatibility with mineral or synthetic fluids having either phosphate ester or water bases. Burst pressures from 8000 to 12,000 psi, depending on size—temperatures from −45° to 250° F. Hytron is available in long lengths—to 1000′; furnished with permanent or reusable couplings.

EASTMAN

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Imperial-Eastman, S.A., Apartado Postal 26544, Mexico 13, D.F.

Imperial-Eastman Corporation, 6300 W. Howard St., Chicago 48, Ill.

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- ☐ High- and ultra-high-pressure assemblies
- ☐ Matched-quality couplings and fittings
- ☐ Hytron hose

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*Company*_____

*Street*_____

*City*_____ *Zone*_____ *State*_____

Lighting Fixtures 472
Entitled "Designs for 1962", this 24-page catalog displays the newest lines of commercial-industrial lighting fixtures. Intended as a reference for contractors, distributors, architects and engineers, the literature describes the fixtures and gives installation data and application suggestions. Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.

Soldering Irons 473
Bulletin GEC-1545A describes a line of industrial soldering irons rated 6 to 230v, 12 to 1250w. The four-page publication includes the "Penline-120" iron designed for light to medium production in electronics and communications industries. A four-page supplement included with the bulletin provides ratings and prices. General Electric Co., Schenectady 5, N.Y.

Solenoid Reference Guide 474
Lists the many different solenoids available for applications such as missile-guidance equipment, fire-control systems, military and industrial computers, hydraulic and pneumatic valves. The six-page fold-out form gives specifications for more than 70 different types of linear solenoids, rotary solenoids and electromagnetic devices. Force-stroke ratings, voltage ranges, current requirements, duty cycle, temperature ranges, weight and size information are given for the units. IMC Magnetics Corp., 6058 Walker Ave., Maywood, Calif.

Free Film Pocket Guide 475
This fall-and-winter guide describes more than 300 movies available on a free loan basis. Films range in content from travel and sports to home craftsman guidance, fashion reviews and an explanation of the stock market. All films are 16-mm-sound and most are in color. A special section of the 32-page guide lists films designed for adult-level interest and education. Some titles in this section are "Between You and the Fish", "Project Hope", "Sounds of Industry", "Copters in Combat and Vertical Assault", "Exhibition Shooting" and "Infrared Spectroscopy". Modern Talking Picture Service, 3 E. 54th St., New York 22, N.Y.

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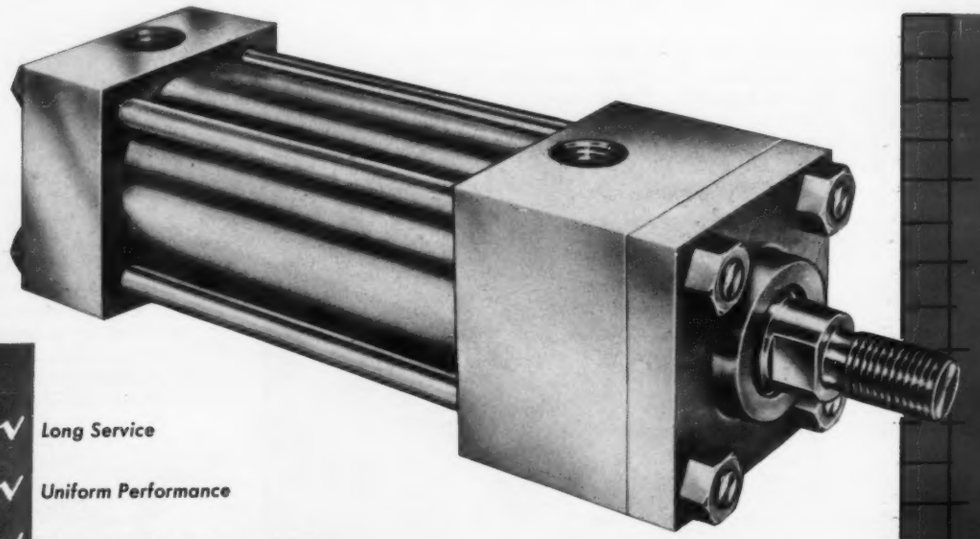

- ✓ *Long Service*
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Air—(rated 200 psi)
Hydraulic—(rated up to 2000 psi)
Meet JIC Standards 1½" to 14" Bores

Made of the highest quality materials and seals, these new components combine modern design, the latest and best engineering advancements with O-M specialized "know how" and precision workmanship.

New Series "K" Air Cylinders

Construction features include brass cylinder barrel, chrome-plated, high tensile steel piston rod with a minimum yield strength of 90,000 to 100,000 psi. Rolled and machined steel heads and extra long cartridge-type rod bearing assure perfect alignment of piston rod.

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Similar in many construction features to Series "K", but specifically designed for hydraulic service. Incorporate vee-type rod packing and a cylinder barrel of micro-honed steel tubing which are best suited for hydraulic operations.

With the addition of the new Series "K" and "L" to the Ortman-Miller major line of air and hydraulic cylinders, you can now rely on O-M for *all* of your low and medium pressure cylinder requirements. Both Series "K" and "L" are dimensionally interchangeable with other cylinders of a like type. Fabricated, precision steel mounts and accessories assure precise mounting.

Mail coupon today for complete details. All cylinders in Bulletins 115A and 116 have been dimensioned in accordance with NFPA recommendations for your convenience.

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The Role of Driving Simulation In Vehicle Design

John Versace,
Chrysler Corp., Detroit, Mich.

Most of the comments made in this paper are drawn from the Proceedings of the Conference on Driving Simulation held in Santa Monica, Calif., in March 1961.

Many of the early emphases on psychological testing, those prevalent before the turn of the century, had to do with reaction time, strength of grip, tapping speed and accuracy, and visual acuity. It was natural that something like reaction time should have been an item of interest with regard to the driving task. So a device that will measure the reaction time to apply the brake is a very specialized driving simulator; it deals only with a very narrow part of the driving task.

The interest with regard to driving was shifted somewhat and a substantial amount of the recent (that is, after 1935) research centered on intellectual processes. However, the simulator as a device did not change too much from its original form.

In the early 1930's Prof. Lauer, at Iowa State, constructed a simulator around an old Essex control system. The driver sat behind the wheel, operated all the controls, thereby causing a miniature car out in front of him to move around on an endless belt roadway. The roadway speed was determined by the accelerator pedal position and the car's lateral position was determined by the steering wheel. A fairly elaborate scenic panorama was built up around this, showing billboards, road signs, electric trains. The AAA Trainer stemmed from this work.

During World War II the need for simulators for training purposes became very pronounced. So there were the famous Link trainers to teach blind flying; numerous gunnery and navigation trainers, and there were even fairly elaborate systems simulators which trained whole crews on such things as antisubmarine warfare. Since the war, the development of simulators of this sort has increased.

In the driving field, there also have been some developments. For example, a widely accepted training device, the Aetna Drivotrainer, consists of a number of automobile "cockpits" and a central movie screen which the students observe and react to. The scoring system is derived from a small computer which correlates actual student

behavior at the controls with what actions the movie called for.

Most of the devices mentioned are used for training purposes, although research has been and is done on them; for example, effects of tranquilizers have been studied on the AAA device. In recent years a simulator has been built at the UCLA Institute for Transportation and Traffic Engineering. An automobile is driven on dynamometer rolls, a connection is made to the front wheels and a wide-angle movie screen plus a small screen for the rear-view mirror present realistic traffic to the driver. Cornell Aeronautical Laboratories did a major feasibility study for the Public Health Service on a large simulator of similar magnitude in which the driver, located in an optical bowl, can control the movement of a miniature TV camera over a miniature landscape. The same technique is envisioned for the UCLA device, and both will simulate accelerations by tilting the whole simulator.

There has been expropriation of the point-source shadowgraph principle from certain aircraft trainers that give an excellent approximation to roadway scenery and still give the operator complete feedback; that is, his control actions affect the display.

As a result of these developments there has been an increased interest in recent years in the design and construction of large-scale universal-purpose simulators to study the driving process. This interest led to the Conference on Driv-Simulation mentioned above. The Conference was sponsored by the United States Public Health Service, the Bureau of Public Roads and the Automotive Safety Foundation. In keeping with the system's philosophy of modern research and development, the conference sought to unite spokesmen for highway, driver and vehicle interests.

Nature of Simulation

1. Testing—The test engineer uses a simulator when he determines the life expectancy of a shock absorber, or of a bearing, or of a set of springs, or

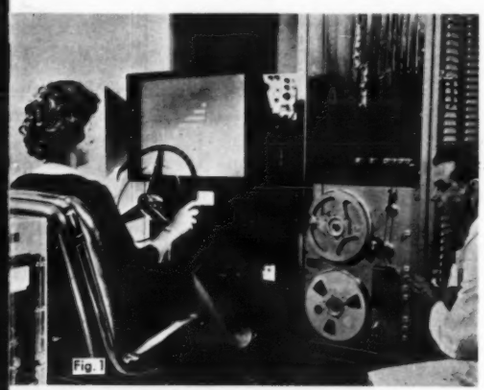
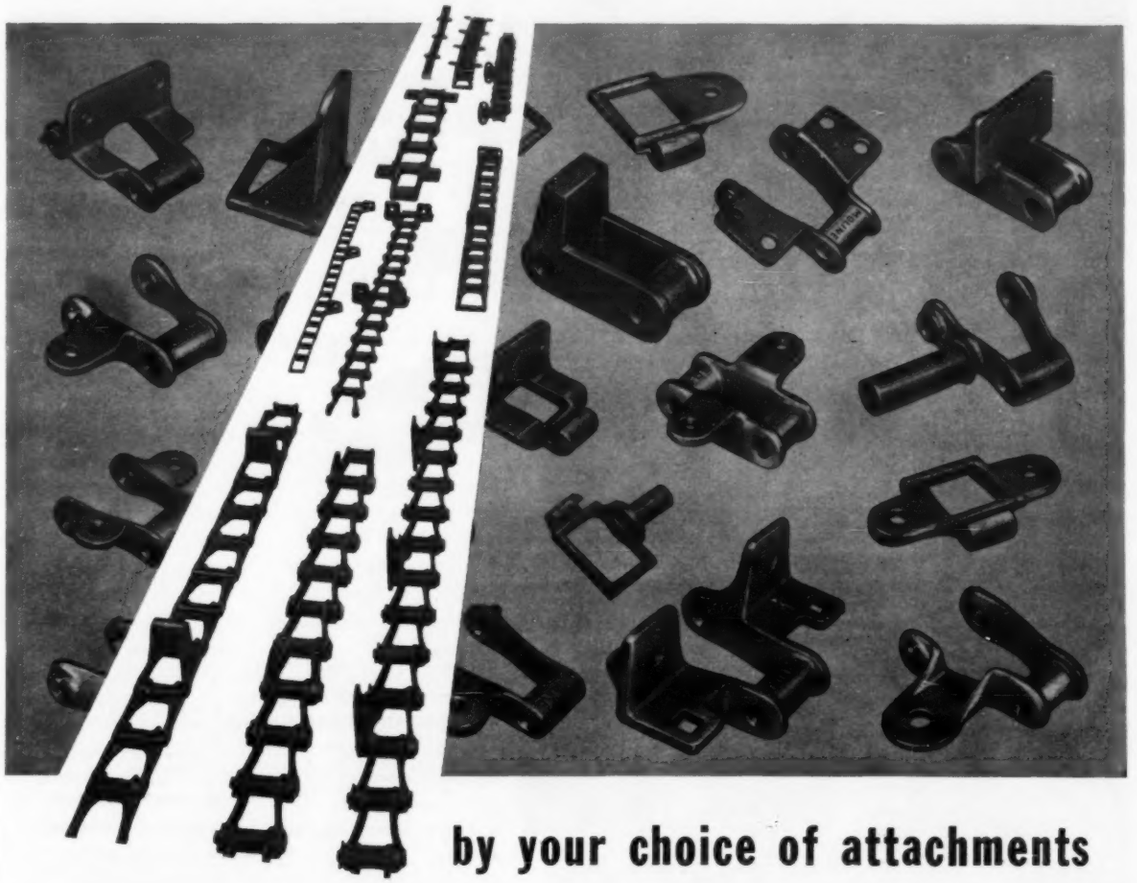


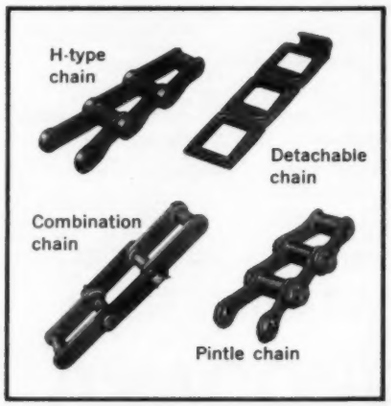
Fig. 1

(Continued on next page)

Moline Chains become freight trains



by your choice of attachments



Put on your imagineering cap and you'll see scores of conveyor ideas in the representative group of Moline chains and attachments shown here... ideas for lifting or lowering, pushing or pulling, scraping or dragging—for every kind of material handling you can think of.

Choose the attachment that solves your conveyor problem. There are hundreds of working combinations utilizing standard chain and attachments that are available in stock. If you don't see the right chain-attachment combination above, ask for the new Moline Design Engineers' Handbook. This new book lists all types and sizes of Moline Chains and attachments and provides hundreds of suggestions on applications and operation. Write for your copy today. And if your problem calls for "special" chains or attachments, consult Moline's engineering service.

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Moline Chains

for conveying, elevating and power transmission

MOLINE MALLEABLE IRON COMPANY

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diversity

A business school prof might call it product diversification to broaden the marketing base, but it all boils down to the basic American drive for a better standard of living. But, all is not so crass! This base broadening business brings *you* the products you need to set your own standards. And since most of our products were designed to meet specific customer demand, we've had a hand jacking up quite a few standards. Before we get too philosophical, let's look at the many things Hoke makes:

1 FORGED NEEDLE VALVES 300 Series:
3000 psi
Brass, 303 SS, 316 SS, Monel
Aluminum ⅛" to ⅜" NPT and with integral tube fittings

2 BAR STOCK NEEDLE VALVES 270 Series:
3000 to 5000 psi
Brass, 430F SS, 316 SS, carbon steel, carbon steel and SS
⅛" to ½" NPT and with integral tube ends

3 PRESSURE REGULATORS 680 Series (gen'l purpose):
Max. delivery press. 140 psig
Max. inlet press. 2500 psig
¼" NPT male needle valve outlet Std. CGA inlet

4 CHECK VALVES 570 and 580 Series:
2000, 3000, 5000 and 6000 psi
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⅛" to ½" NPT and with integral tube fittings.
Ball and piston types

5 SOLENOID VALVES Series 90 (2-way type): Series 95 (3-way type):
Differential press. ratings to 2000 psi
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Choice of coils, housings, corrosion-resistant trim

6 BAR STOCK NEEDLE VALVES 280 Series (metering):
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Brass, 316 SS
⅛" and ¼" NPT
1/16" and ⅛" orifice

7 PACKLESS VALVES 473 Series (bellows seal):
400 and 2000 psi
316 SS
½" NPT

8 PRESSURE REGULATORS 920 Series (ballast operated):
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Driving Simulation . . . *Cont.*

of a new alloy, by subjecting it to a cycling of forces representative of what will be encountered in its final application.

2. Mathematical expression—Any differential equation which describes a dynamic system is a simulation.

3. Analog Computer—This is a hardware representation, still symbolic, of the mathematical expression.

4. Analog computer plus some manual controls and simple displays—An outstanding example is a device (Fig. 1) in the Human Factors group at GM's Research Laboratories.

5. Analog computer plus all pertinent manual controls, plus extensive external display, plus motion—"Driving" such a simulator should be as close to the real thing as it would be possible to make it.

In studying a system we are faced with a very touchy problem, that of measuring performance or system functioning. This will be considered later, but before that, let's consider a little more fundamentally some of the issues that support the use of simulation. There are a few basic reasons:

1. Cost—Real-life experimentation of the scope envisioned simply could not be carried out.

2. Safety—One of the important uses is the study of system functioning under very hazardous conditions.

3. Efficiency—This refers to experimental efficiency. If you cannot control your conditions, you are faced with conclusions in which all else is never equal.

There are two classes of research methods. In one, we take the world as we find it and go about the business of describing it as we find it.

The second class of research methods includes those techniques which we call experimental, as opposed to survey. In the experimental approach, we have the enormous advantage of controlling the situations, rather than taking the situations as we find them.

Measurement

The question of measurement has been mentioned. We come to an important decision point. If we cannot make measurements, there is no point in doing an experiment; and if a device cannot yield measurements, there is no point in building it.

Criterion

What shall we measure? Presumably, our interest here ultimately is in traffic safety. It would seem that the most relevant measure, for our ultimate purpose, would be a count of number of accidents or number of accident fatalities.

The accident frequency may be the ultimate criterion, but it has subordinated to it a long line of criteria, each serving as a stepping stone to the next higher one. Measurements are associated with each of these subordinate criteria.

In a simulated driving task, the amount of exposure required to yield directly reliable measurements of the ultimate criterion may be far in excess of what can be accomplished practically. Although this exposure can be accelerated by presenting concentrated sequences of the critical events that predispose accidents, extreme care must be taken so that results observed under these conditions are not gross distortions because of the artificiality of such a sequence.

Fidelity

It would seem that the question of simulation fidelity must be answered for each research problem that arises. Intimately connected with the question of fidelity is that of relevance of the measurements of system performance. In some cases a completely abstract and utterly artificial kind of simulation environment is entirely adequate, and in some cases it may be desirable and necessary to use simulation conditions that are deliberately unrealistic as far as surface appearance goes.

One limitation in the specification for research simulators, for other than ad hoc study of specialized problems, is the general absence of a comprehensive theory of driving behavior. A complete job description of the driving task would for that matter be useful. But a detailed theory including mathematical formulation of axioms and postulates, from which would stem very specific hypotheses to be evaluated would be one of the major steps forward in the systematic approach to driving research.

Practical limitations with some current approaches to simulation suggest the need for some substantial preliminary research on the elements of the simulator.

Conclusion

Research orientation toward experimentation as a necessary accompaniment and extension of the more limited approaches commonly taken implies the use of simulation techniques. But, it is not the verisimilitude of reproduction or high fidelity of appearances that is the most pertinent consideration.

There is a need to clarify many of the phenomena observed in present approaches to simulation because in many respects the specification of simulator design would depend on these findings.

Abstracted from technical paper SAE #366B; $1.; to SAE members, $0.75. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N.Y.

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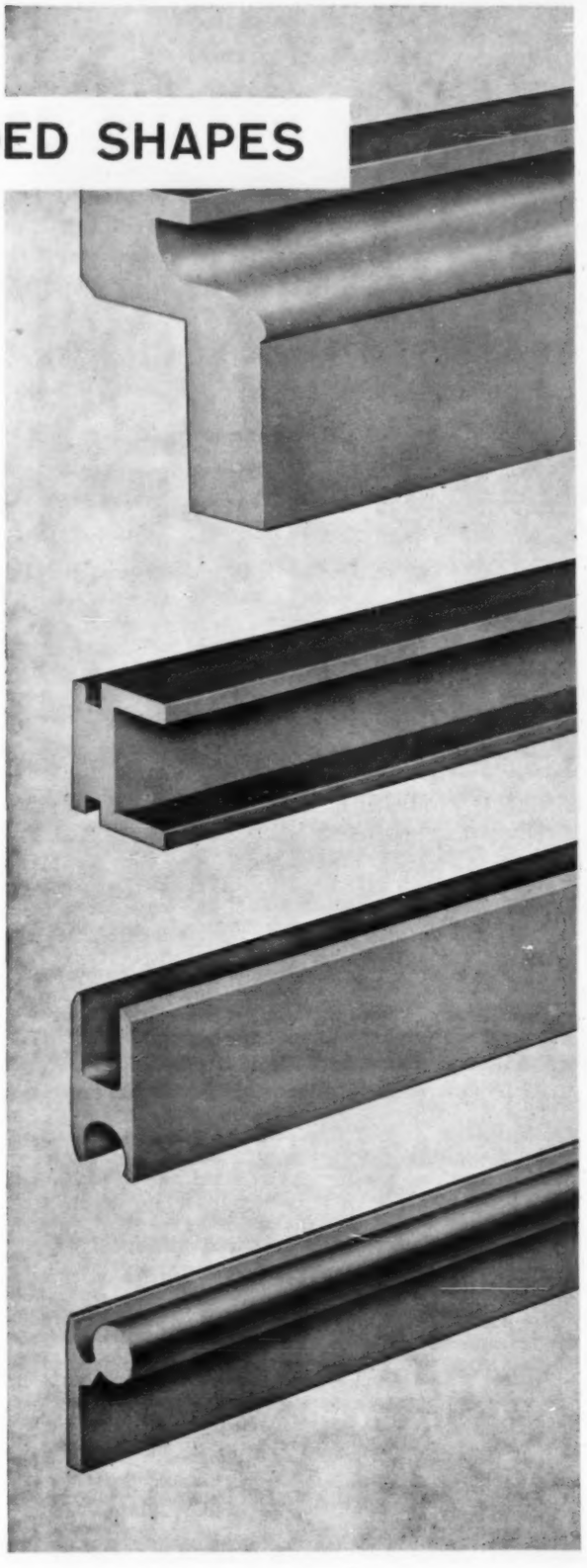

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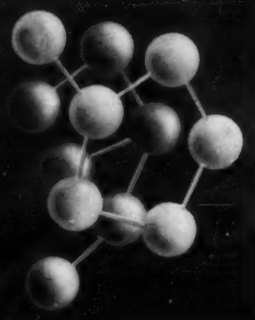

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TECHNICAL PAPERS

A Decision Logic For Speech Recognition

William C. Dersch
IBM Corp., Advanced Systems
Development Div. Laboratory
San Jose, Calif.

Speech varies with the speaker, and with the emotional, grammatical and environmental contexts in which words are spoken. The ear and mind readily overcome differences in amplitude or loudness, frequency or pitch, tone, intonation and inflection.

People have an efficient self-organizing memory, the human brain. We have no such brain at our disposal for mechanical speech recognition, although we do have computers.

For simplicity, we set ourselves the task of recognizing words without the aid of a large-scale computer.

Fig. 1 is a simple block diagram of a speech-recognition device.

We want to measure certain properties of an electrical analog of the speech pressure wave; store these measured properties in an ordered sequence; analyze the stored information, and decide which word was spoken.

Because full recognition of continuous speech could at best be attained only by degrees, we attacked first a simplified version of the problem. Thus, the following limitations would be permitted in the operation of the logic:

1. To supply word boundaries, spoken words would be artificially separated in time.
2. Words would be spoken "naturally": i.e., not shouted, sung, whispered or mumbled.
3. Adjustment would be permitted in order to match the logic to the voice characteristic of the speaker.
4. Some training of the speaker (about an hour or so) would be allowed to accommodate the machine.
5. The vocabulary would be limited.

Our words would be common rather than highly special or coded words. There would be no a priori word-ordering logic; the circuit would be able to recognize any of the words in the vocabulary in any sequence. The device would operate in "real time", identifying words as they are spoken rather than 10 minutes or an hour later. The equipment was to be relatively insensitive to room noise.

We were not in search of a general theory of machine speech recognition—nor do we have any such theory. We have approached the problem in a relatively new way.

To keep hardware simple, we made recognition

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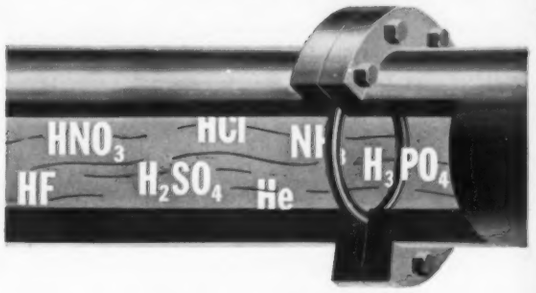

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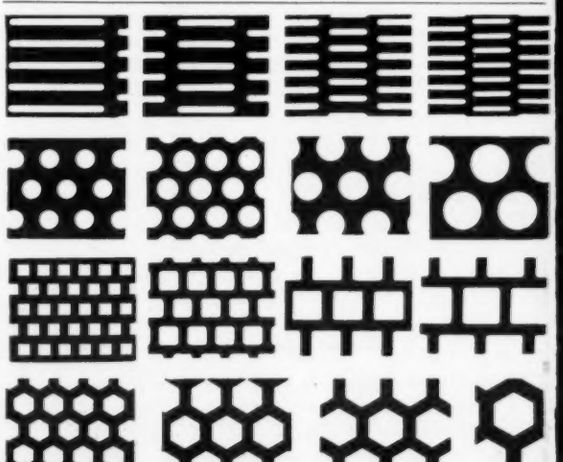

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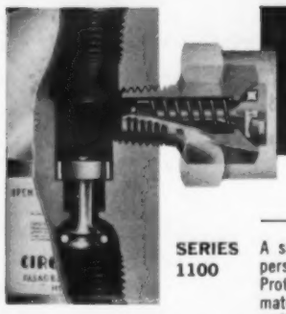

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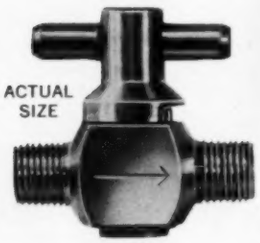

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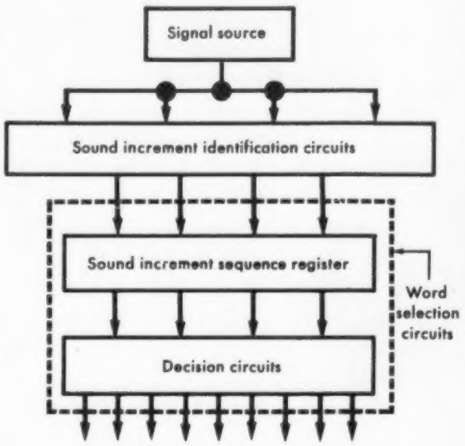

Fig. 1 **ELEMENTARY SYSTEM LOGIC FLOW**

dependent upon the simple occurrence or nonoccurrence of certain acoustical events, rather than upon measurements that are complex.

Let us distinguish, with a high degree of reliability, two of the most general characteristics of spoken words, namely voiced sounds and frictional or fricative sounds. Voiced sounds are those that originate in the vocal cords, which vibrate when air passes through them. Frictional sounds, result when the tongue, teeth or lips form a constriction through which air passes.

Voiced sounds we call machine vowels, and frictional sounds we call machine consonants. Frictional sounds are identified positively and thus can be separated from ambient noise. Under this definition, "l", "m", "n", "r", "z" and "w", for example, are all classified as machine vowels. Machine vowels and machine consonants are in no way analogous to linguistic vowels and consonants.

We now put this ability to distinguish machine vowels from machine consonants to work, recognizing a small number of "monovoiced" spoken entities. We are not at all limited to a monovoiced word vocabulary. Natural internal word constraints favor recognition of polyvoiced words. However,

Code	Spoken digit
V	1
FV	2
FV	3
FV	4
FVF	5
FVF	6
FV	7
VF	8
V	9
(VF) simultaneous	0

FIG. 2 GROSS WORD–CODE

(Continued on next page)

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Class	Spoken word
V	1, 9
FV	2, 3, 4, 7
FVF	5, 6
VF	8
(VF) simultaneous	0

FIG. 3 GROSS WORD–CODE AND WORD–CODE FAMILIES

to exemplify the logical system, let us use the 10 digits, spoken naturally.

If voicing is symbolized by V and friction by F, we may code our digits as in Fig. 2.

The logical system consistently classifies the terminal "v" in "five" as a frictional sound. It classifies the nonterminal "v" in "seven" as a voiced sound. In the terminal "v", the vocal cords characteristically stop beating before the energizing air stream from the lungs completely ceases, and the lips and teeth produce a weak "f" sound. If we pronounce "five" in a natural and unhurried manner, it sounds like "fivef". This condition does not exist in "seven". With an untrained speaker, the device often fails, not because it cannot detect the terminal "v", but because the "v" was not sounded. When the speaker has been trained to say "five", and not "fi", the device generally responds quite satisfactorily.

It is apparent that we have narrowed the number of classes to five and that two of these classes contain but one member each, as tabulated in Fig. 3.

In the circuits we distinguish between "strong"

Class	Spoken word
V	1, 9
F_s V	2, 7
F_w V	3, 4
F_w V F_w	5
F_s V F_s	6
V F_s	8
(VF) simultaneous	0

FIG. 4 INTERMEDIATE WORD–CODE AND WORD–CODE FAMILIES (1)

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CLASS	SPOKEN WORD
$V_{1-\bar{9}}$	1
F_s $V_{2-\bar{7}}$	2
F_w $V_{3-\bar{4}}$	3
F_w $V_{\bar{3}-4}$	4
F_w VF_w	5
F_s VF_s	6
F_s $V_{\bar{2}-7}$	7
VF_s	8
$V_{\bar{1}-9}$	9
(VF) simultaneous	0

Fig. 5 INTERMEDIATE WORD–CODE AND WORD–CODE FAMILIES (11)

frictional sounds, e.g., "s", hard "t" and "x", and "weak" frictional sounds, e.g., "f", sometimes "v" and "th". Thus where F_s symbolizes strong friction and F_w symbolizes weak friction, our classes and their members become those of Fig. 4.

For this vocabulary, three different measurements are sufficient to identify four words and to place the other six in three classes, each with but two members. Three further tests of the voicing measurement, invoked as required, serve, in the present example, to distinguish 1 from 9, 2 from 7, and 3 from 4. Classes and their members now may be summarized as in Fig. 5.

This, in a simplified way, is the logic that has evolved.

We have succeeded in escaping the difficulties of word registration and segmentation. The "machine syllables" are divided in accordance neither with the syllables of spoken words, nor with a conventional set of phonemes. Rather, the "machine syllables" are established by the logic itself in re-

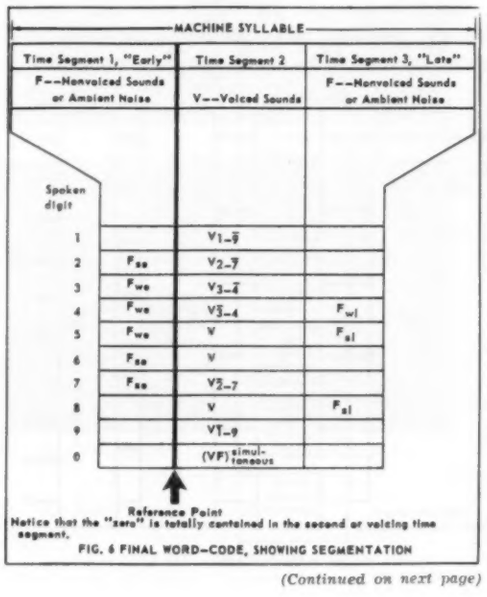

FIG. 6 FINAL WORD–CODE, SHOWING SEGMENTATION

(Continued on next page)

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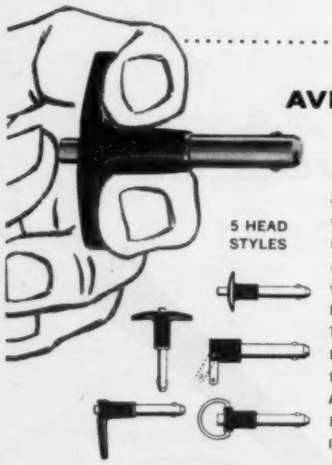

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Speech Recognition . . . Cont.

sponse to the time-variable characteristics of electrical signals corresponding to the spoken words. By a variety of measurements, none of which produce information corresponding directly to any of our common categories, spoken sound increments are established. These combine to uniquely identify the members of our limited vocabulary of "monovoiced" words.

In the "monovoiced" vocabulary, the "machine syllable" is always composed of three time segments. The voiced sound increment (which, by definition, always occurs) is always and without compromise recorded in the middle segment. In the first and third segments the frictional sounds are recorded, if and when they occur. Voicing never appears in the first and last segments. Further, the location of each sound measurement is determined by reference to a point in the word, namely, the onset of voicing.

Both rigid tripartite segmentation and reference point are fundamental to our logic. Our storage circuits and decision circuits are, effectively, the same. In order that the simple network may perform a complex function, the same kind of information must always be in the same place.

Because the voicing property of speech is the most reliable measurement, we use it to control the format of our information.

The friction sounds in Fig. 5 should bear the subscripts "e" or "l", depending on whether they come earlier or later than voicing, and a more complete representation of our logic would be that of Figs. 6 and 7.

Take, for example, the spoken word "six". During the ramp-like energy buildup of the initial "s" sound, the weak friction indicator responds first

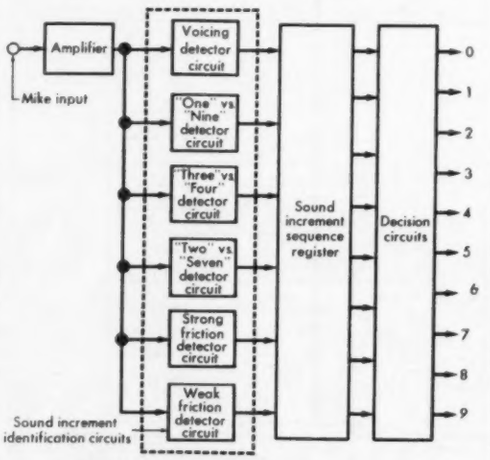

Fig. 7 SYSTEM FLOW DIAGRAM

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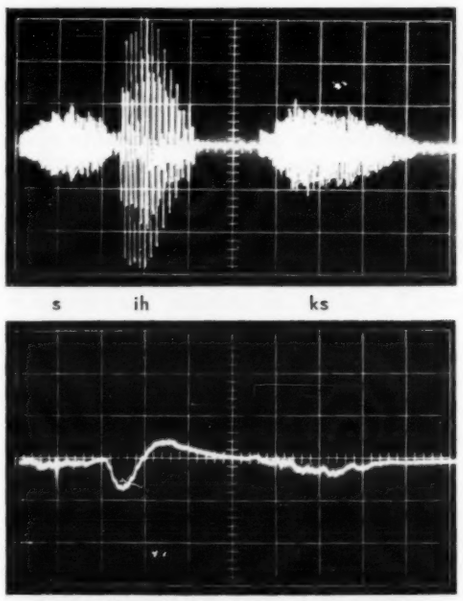
but is negated by the strong friction indicator when the energy reaches full strength. The system transfers this classification to a storage relay. The next event—the voiced "ih"—causes the voicing indicator to respond and establishes the registration mark. The preceding strong friction measurement, which had been stored in the hold relay, now is assigned an "early" designation and transferred to the first time-base segment. The voiced part of the machine syllable is, of course, entered in the middle time-base segment. The final "ks" sound starts abruptly, causing the strong friction indicator to respond again. As the word terminates, the energy in the sound wave declines, finally causing the weak friction indicator to respond. In our logic a strong friction measurement always takes precedence over a weak friction measurement when both occur in the same time-base segment. Therefore, the weak friction measurement is discarded and a "strong friction late" indication is transferred to the third time-base segment. Because the code $F_{se}VF_{sl}$ uniquely identifies the "six", no further measurements need be made.

We can detect voicing with accuracy well in excess of 99 percent and can detect it over widely varying energy levels and in the presence of relatively high noise.



A. Oscillograph of time–energy distribution in spoken word six

B. Asymmetry envelope sum of 8A

Fig. 8

(Continued on next page)

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Other big advantages of G-E glow lamps are their rugged construction, small size (shown actual size above) and low power consumption. They run on line voltage with no transformer required and use only a small fraction of a watt. A word to the wise: if you're designing appliances, business machines or military hardware, get the story on General Electric glow lamps as indicators. There are over 60. Write: General Electric Co., Miniature Lamp Dept. M-145, Nela Park, Cleveland 12, Ohio.

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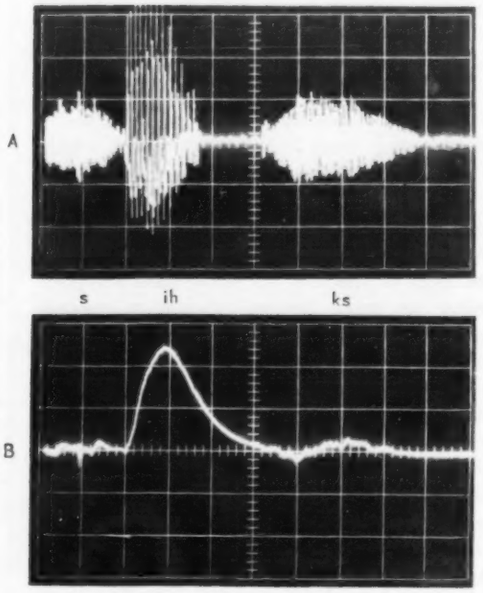

A. Oscillograph of time–energy distribution in spoken word six after phase–shift processing

B. Asymmetry envelope sum of A

Fig. 9

Consider the oscillograph of the energy distribution in the word "six" as shown in Fig. 8A. It is not evident from Fig. 8A that the voiced or "ih" part of the word contains positive peaks greater in amplitude than the corresponding negative peaks. But if we sum the positive and negative "envelopes", as in Fig. 8B, the "asymmetry" is immediately apparent. This asymmetrical character of the voicing sound is significant because it does not occur in either nonvoiced sounds or typical ambient noise. It is almost an exclusive characteristic of voiced speech, when sounds are smoothed to a syllable rate.

We can enhance this asymmetry so that it is always unidirectional for all voiced sounds by passing the speech wave through an "all-frequency-pass" phase shift filter as shown in Fig. 9A. Note the change in the appearance of the voiced segment of the waveform and also that the remainder of the waveform virtually is unaffected. Summing the positive and negative envelopes (Fig. 9B), we see displayed the presence of a machine vowel.

In Figs. 10A and B, the same spoken word can be observed after processing in the presence of amplified fan noise.

It is an interesting fact that the slight degree of phase shift so important in our scheme of voicing

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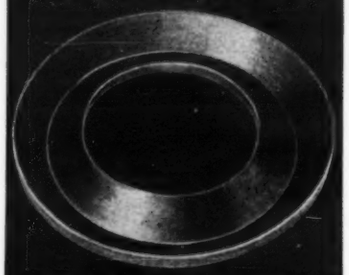

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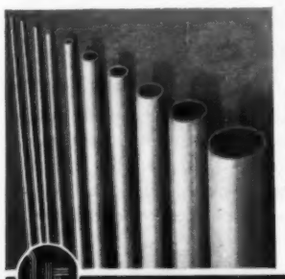

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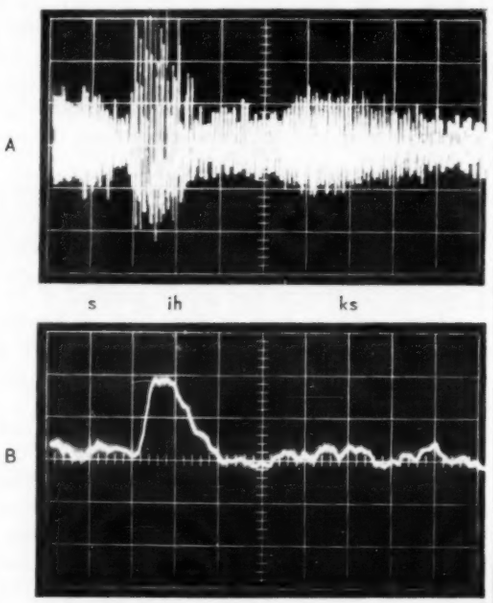
detection is apparently completely imperceptible to human listeners:

1. First triplet: no phase shift
2. Second triplet: +, 0, − asymmetry caused by phase shift

The scores of a small sample of speakers with nominal training have ranged from about one to six errors for 100 pronunciations, in an unprotected room environment. The reader will appreciate that we are still far from a fully practical device.

We believe we get further by not requiring that our logic perform a human function in the same way and with the same information that humans do. There is no reason to believe that humans make use of all of the information in the speech wave, or that a device need be restricted to human information or that it will invariably find such information most useful.

Presented at the Symposium on Bionics, sponsored by Wright Air Development Div., meeting in Dayton, Ohio, Sept. 13-15, 1960.



A. Word six spoken in the presence of fan noise (after phase-shift)

B. Asymmetry envelope sum of A

Fig. 10

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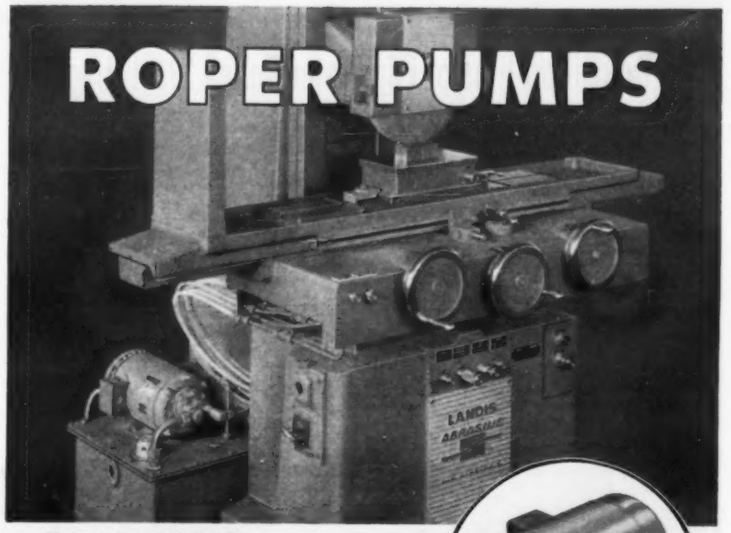

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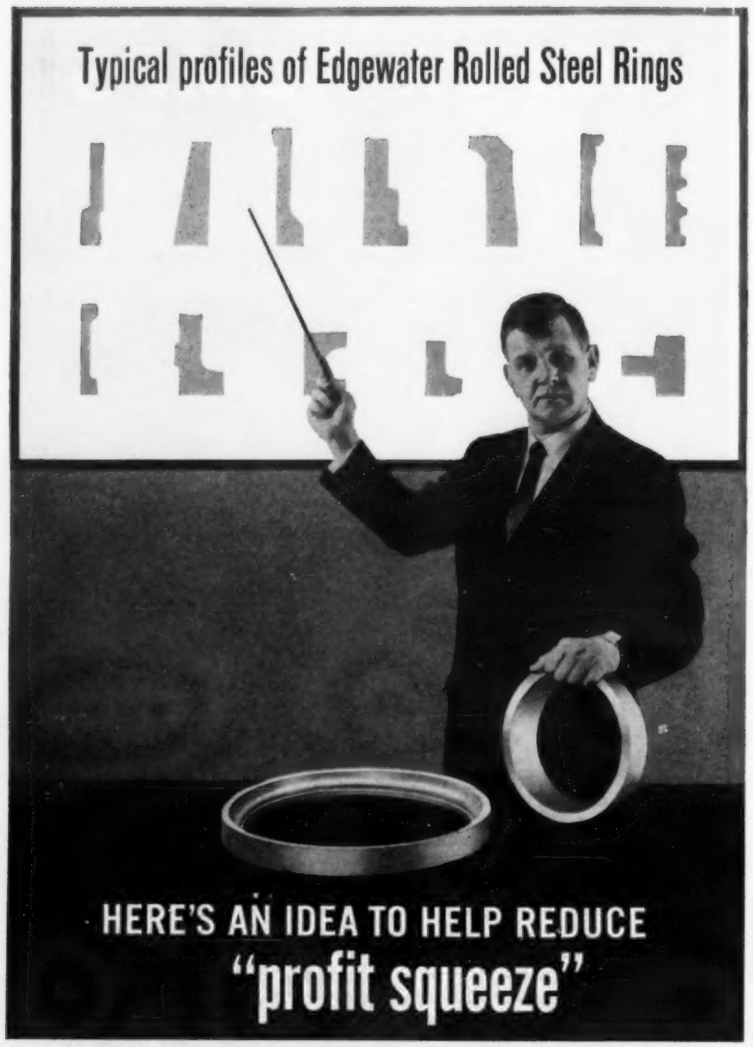

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How Industry Educates Engineers To Use Digital Computers

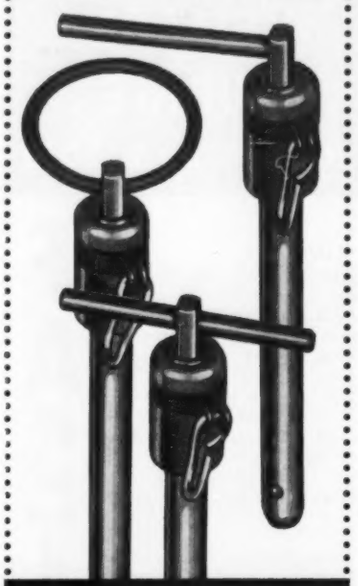
J. L. Davie,
McDonnell Automation Center

Everyone recognizes the problems of bridging the gap in training between the student who has just been graduated and the productive employee. A major effort has been made in industry to provide this bridging whether it be through formal classes, apprentice on-the-job training, formal training through plans on the campus of local universities, evening study classes at the place of employment or leaves of absence from work to study at a special school. Industry has been very willing to counsel and coordinate the efforts of employees toward personal development.

One of the critical areas where this additional training is necessary is in the field of electronics and electronic equipment. This includes the useful applications of analog and digital computing equipment. The successful utilization of these powerful tools is the responsibility of the industry using them. The hardware and operations of computers are essentially the same but when these tools are applied to the specific problems and specific types of work in different companies, the methods of programming and computer applications become different.

There are three major problems that industry has to consider when planning training classes for engineers within the plant: (1) What subjects should be offered and how should they be presented? (2) How to find people qualified on the subject and train them in their duties as instructors? (3) How to present the material in such a way that this captive audience will feel it is not wasting its time.

The problem of how to present the computer and computer applications is unique because of the different areas serviced by a computer group. The method of presenting the material is a function of the type of computing facility and the particular interest of the class. There are essentially two types of organizations in the computing field. The first is a Closed Shop Computing Department in which all of the work connected with preparing programs, preparing data for production and operating the equipment is done by members of the Centralized Computing Department. This type of



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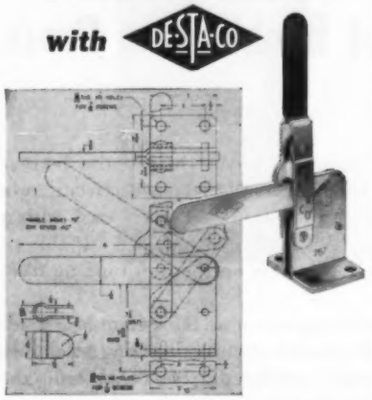

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organization attempts to provide the most computing for dollars spent by providing a group of specialists in their field for service to the different divisions.

The second type of computer organization is the Open Shop computer group. An Open Shop group may consist of one large computer and the Program Staff consists of people located in various departments serviced by the computer. The Open Shop group also may consist of smaller computers actually installed in the departments requiring their services. In either case, the communication of new ideas, better methods and new applications is deterred by the small groups of computer-oriented people that are probably working only part-time as programmers. There is a great amount of duplication of effort in this type of organization. The advantage of an Open Shop computer service is that the computer and the people planning and operating the computer are in the same area as the work.

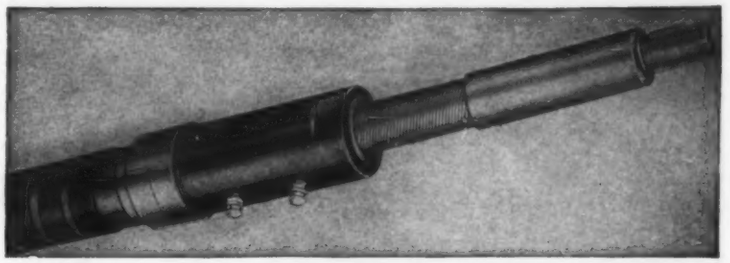
The method of educating the engineer in these two types of organizations is different. In either case, the engineer wants to know how a computer works and what type of problems it can solve. A class taught in the centralized environment will include the basic operations of a computer and a set of basic operation codes.

The main problem area has been and will be the tremendous changes in computer equipment and methods of programming.

Training just the people using the computers and people actually engaged in doing the work on the computers is not sufficient. Supervision represents the key areas where good training is necessary. If the supervisors are not aware of the capabilities and possibilities of electronic data-processing computer, then their use will not be considered in planning the work. This same reasoning can be used to include middle and top management.

The following educational system is recommended as a means for industry to fully recognize and utilize the electronic data-processing equipment available today: (1) hold periodic seminars for middle and top management; (2) provide training classes for supervisors in which the main subject is present computer applications and possible future application areas, and (3) offer training classes for the engineer who is actively engaged in the area of work where computer applications exist.

Abstracted from technical paper No. 372B; $1; to SAE members, $0.75. Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.



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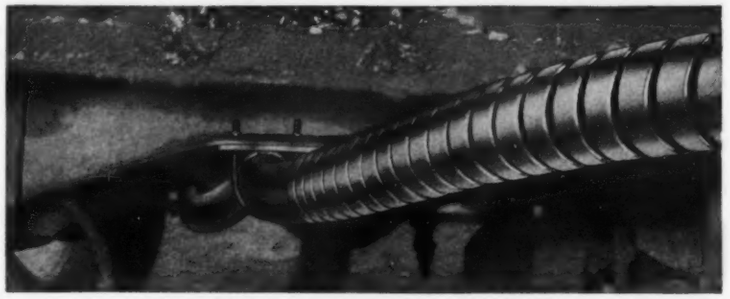

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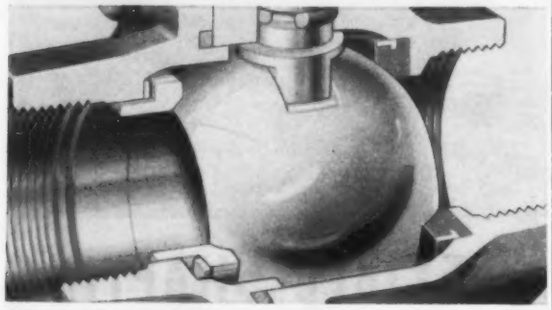

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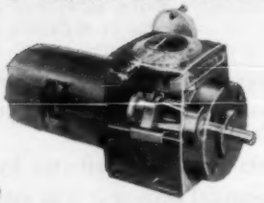

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Air-Oil Booster Speeds Operation of Bookbinding Press

E. J. Stefanides, Central States Editor

A bookbindery press uses a semi-automatic, pneumatically actuated hydraulic booster circuit to provide the intensified hydraulic pressure required with fast thermosetting plastic glues. Controlled by a simple arrangement of pushbuttons, solenoid valves and time-delay relays, the system provides a uniformly repetitive cycle with variable, timed periods of high and low pressure.

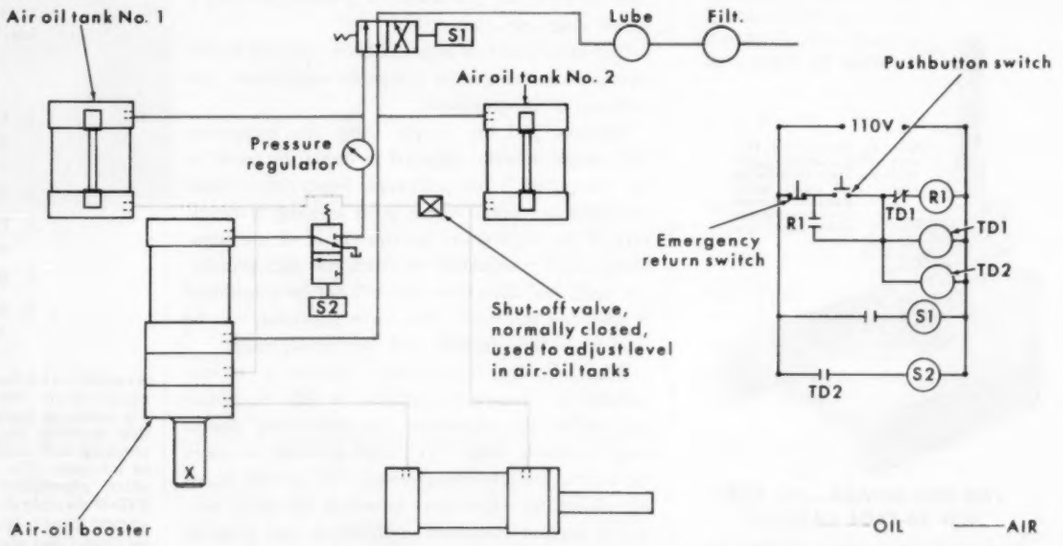
One of the problems is the variety in overall dimensions of the books to be bound. This variety in sizes requires a press which can be adjusted quickly to provide a wide range of pressure and duration of timing cycles.

The pneumatically actuated hydraulic booster circuit is particularly well suited for this purpose. Operating off normal air line pressure, the circuit provides a ram force proportional to line pressure. Thus, ram force can be adjusted easily by merely incorporating a reducing valve between the booster and the line. In this press, the booster circuit provides pressure amplification and when used with a regulating valve on a 100-psi line, it is capable of supplying hydraulic forces on the ram ranging from 0 to 22,800 lb.

The pneumatic actuation of the system also lends itself to simple control circuits, utilizing solenoids, valves and simple timing devices to provide the variable cycle durations.

Basically, the circuit consists of two air-oil tanks, and air-to-oil booster and hydraulic cylinder. The air-oil tanks provide for low-pressure actuation and return of the ram. The booster contains a differential area piston to provide for development of the high-intensity force required during the actual setting of the adhesive.

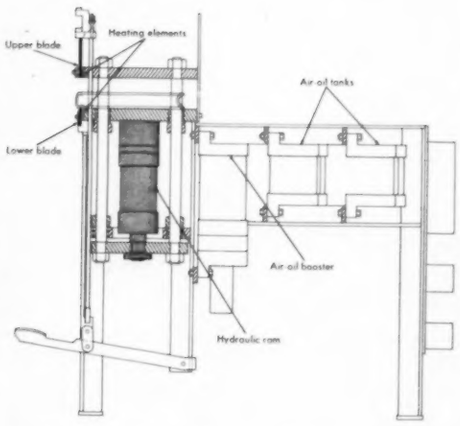
Mechanically, the press incorporates a set of ad-



AIR-OIL BOOSTER CIRCUIT is activated by closing pushbutton switch energizing solenoid valve No. 1 and both time-delay relays. Solenoid valve allows line air to enter air-oil tank, displacing oil through lower ports of booster to hydraulic ram and bringing upper platen into contact with book. After predetermined time interval, time-delay relay No. 2 closes energizing solenoid No. 2, allowing line air to enter on top of booster piston. As booster piston moves down, it isolates air-oil tank No. 1, raises pressure to desired intensified level. After predetermined interval time, delay relay No. 1 opens de-energizing solenoid No. 1, allowing air-oil tank No. 2 to return cylinder and booster to inactive position. Variables in circuit provide a 0 to 22,800-lb range in force and a 0 to 30-sec range in time duration of high and low-pressure cycles.

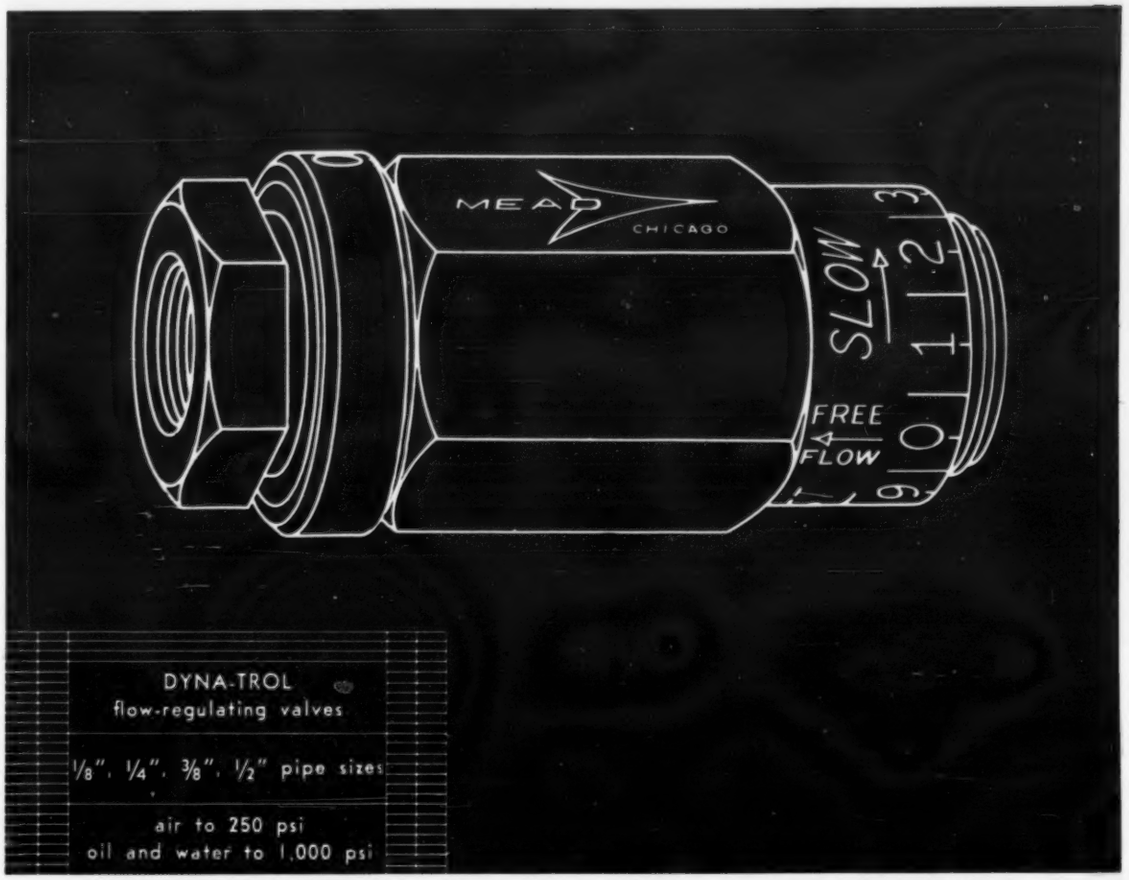
justable blades which forms the joint on either side of the spine, or backbone, of the book. One set of these is attached to the lower platen while the other set is spring loaded and can be lowered by a foot pedal independently of the ram-actuated upper platen. This provides a safety feature allowing the book to be set up and blades to be aligned with the joints before the ram is actuated.

The system was designed by the S-P Mfg. Corp., Cleveland, Ohio, under the direction of Merritt Sampson, Vice President of Engineering. The bookbinding machine in which it is used was designed and built by The Superior Tool & Machine Co., Akron, Ohio, for the Crawford Bindery in the same city.



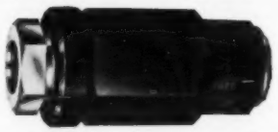
ARRANGEMENT of booster circuit components on frame. Upper platen is driven by ram through tie rods. Upper joint blade is spring loaded, can be lowered by foot pedal independently of ram. Strip heaters in platen edges provide heat required for fast-setting of plastic glues.

For Free Reprints of the Above Article, Circle 526 on Reader-Service Card



PROBLEM: *how to replace a 1/4" valve with a less-costly 1/8" valve (and get extra precision in low-flow ranges)*

SOLUTION: NEW MEAD DYNA-TROL VALVE



Check these design advantages of the new MEAD DYNA-TROL flow-regulating valve:

- Adjusting sleeve — easily rotated by hand — locks to any setting and cannot be accidentally removed from valve body
- Calibrated sleeve records settings for future reference
- Knife-edge variable orifice reduces flow distortion caused by viscosity changes in working medium
- No internal springs to cause malfunction
- All parts rust-proof
- Wide operating range: −40° F. to +250° F.

Small, economical MEAD DYNA-TROL flow-regulating valves can replace more costly valves of larger pipe size. Reason: Internal design permits pneumatic or hydraulic flow equal to full pipe area in both directions. The first 360° turn of the adjusting sleeve increases flow from zero to about 10% of potential — a new measure of precision in low-flow ranges. Successive turns accurately reach 100% of pipe capacity. To cut costs and give exacting control to piston speeds, specify MEAD DYNA-TROL valves to solve your flow regulating problems. For information on quick delivery, write to MEAD *today.*

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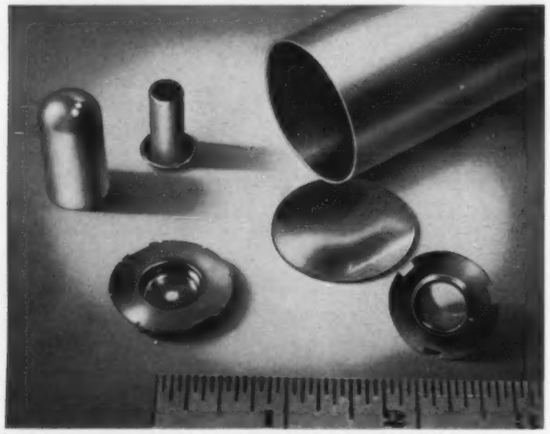

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Model C Check Valve for In-Line Mounting.

TYPICAL APPLICATIONS

ARROW INDICATES DIRECTION OF CONTROL

CLOSE CONNECTION

Controlling Double Acting Cylinder

TWO DIRECTION CONTROL

CLOSE CONNECTION

Controlling Single Acting Cylinder

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Electrical Bridge and Drive Simulate Diesel

Edward W. Schrader, Western Editor

The output of an electrical bridge serves as the input to an electronically speed-controlled motor to test diesel-engine governors. To calibrate the governor on the test stand, a Reliance "V-S Jr" drive simulates diesel-engine speed. The position of the governor's control shaft is transmitted to the potentiometer bridge through an indicator cord. A cord and pulley connection between the governor and the sensing unit is necessary for the wide variety encountered in various types of diesel-engine governor-control shaft arrangements.

The engine simulator unit, an electrical bridge, supplies the motor speed-control system with a voltage proportional to the movement of the governor-control shaft. It also provides four fixed-voltage steps which cause fixed-speed changes in the drive motor. This places the governor under test in an operational type of situation.

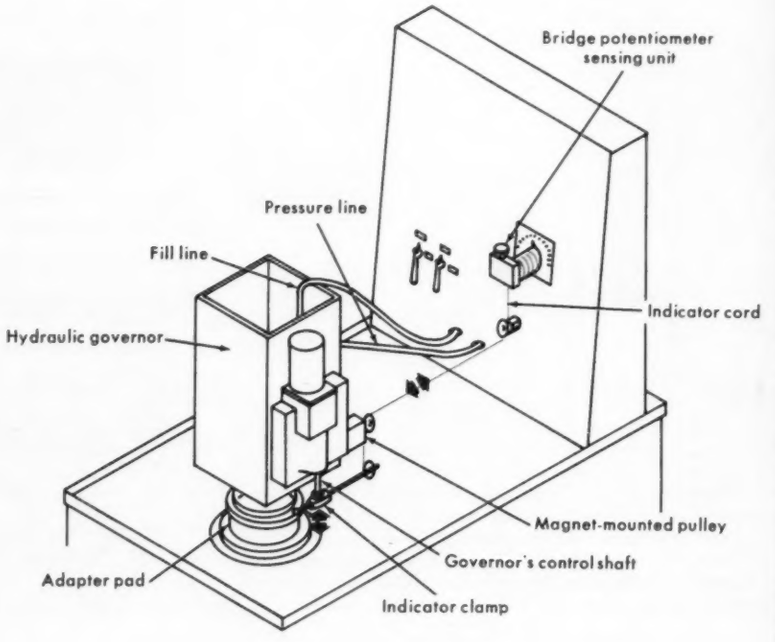
Functionally, the engine simulator is a Wheatstone bridge with a regulated power supply derived from the filament supply to the motor-control unit. When in balance, the bridge output is zero. When unbalanced, the output voltage is applied to the grid of the input tube in the motor speed-control unit. This tube regulates the speed of the motor. A speed change proportional to the voltage applied from the bridge therefore will result. The bridge may be unbalanced in two ways: (1) by rotation of the sensing-unit potentiometer or (2) by a step switch.

In the case of the sensing potentiometer, the linkage to the governor under test permits the governor shaft to control the speed of the drive motor. A directional switch (for increase or decrease of speed) reverses the polarity of the voltage supplied to the bridge. A step switch successively moves the points at which the bridge-supply voltage is applied in predetermined steps. This also unbalances the bridge and controls the speed of the drive motor.

Motion of the governor arm then may restore the motor speed to its original value by rebalancing the bridge. The arm actually rotates the sensing potentiometer. The arrangement is identical to the control of engine speed by a throttle control.

The simulator operates as an overriding grid-bias supply on the control tube in the motor speed-control unit.

The hydraulic governor test stand including engine simulator is a design development of Marine Pumps Div. of Diesel Control Corp., Wilmington, Calif.

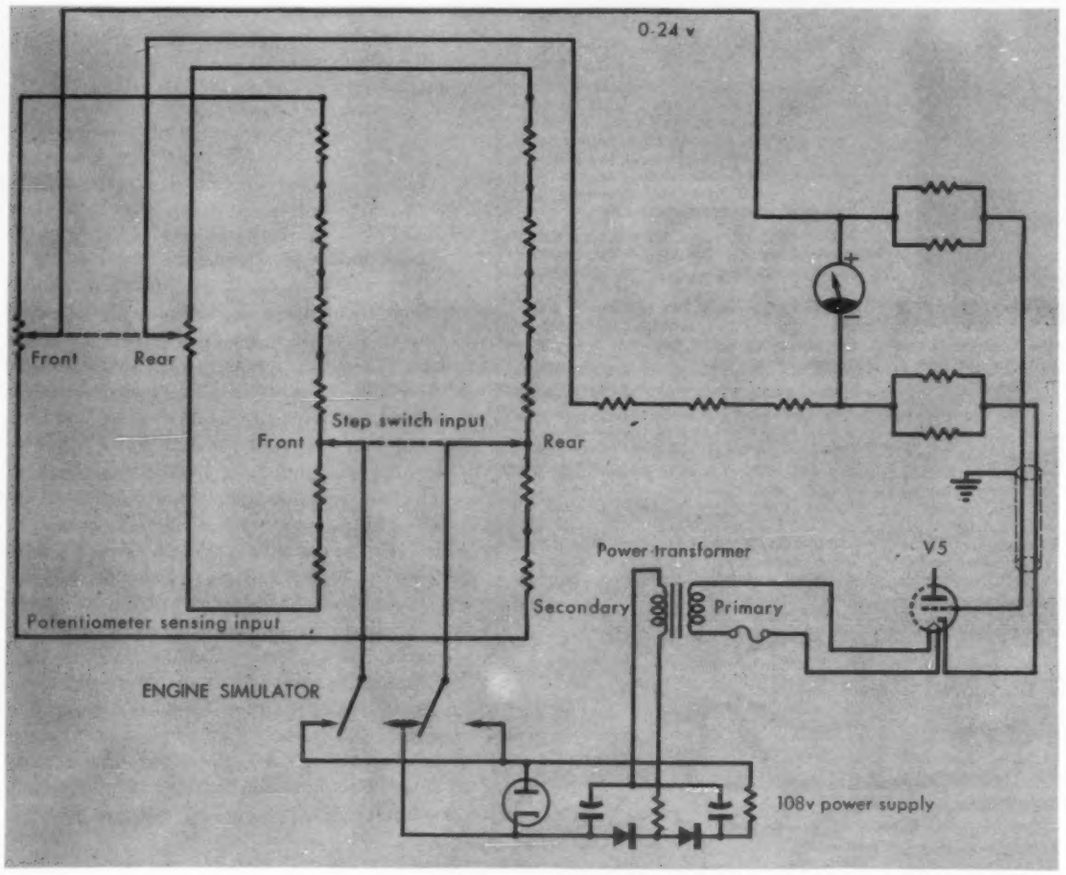


CONTROL SHAFT of hydraulic governor under test gives mechanical input to engine simulator to correct speed error and check governor operation. Indicator cord connects linkage movement of governor to electrical bridge potentiometer sensing unit mounted behind panel, thus inducing electrical signal to electronic motor control to change drive motor speed for governor test.

Engine in Governor Test

TEST STAND adapts to most configurations and makes of hydraulic governors. Simplicity of cord control to sensing unit allows for versatility of adaptation. Simulator controls governor being tested and indicates governor speed drop.

SIMPLIFIED ELECTRICAL SCHEMATIC shows electrical bridge sensing unit. Signal to grid of tube V-5 changes drive motor speed, increasing or decreasing, as required to simulate governor action in throttle control of diesel engine.



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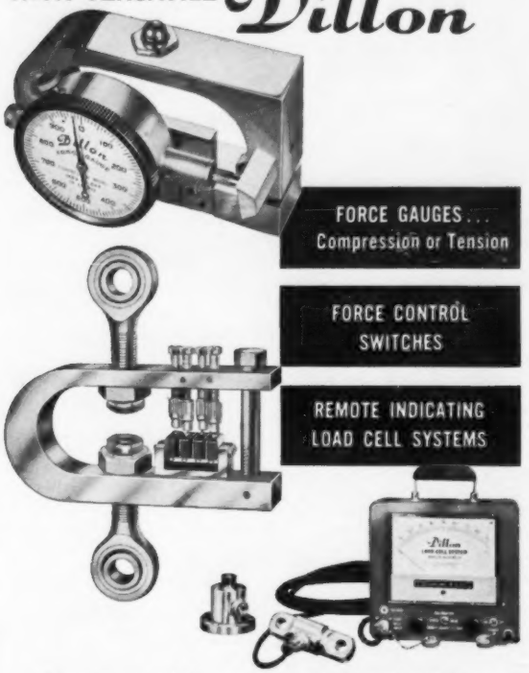

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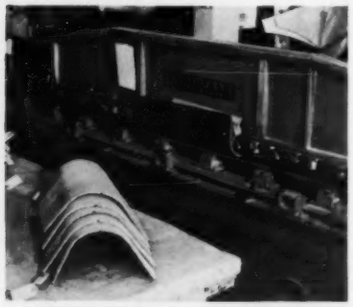
#10 CURVING AND CONTOURING HONEYCOMB IS EASY WITH THE RIGHT TECHNIQUE

More Honeycomb Sandwich Used Today Curved or Contoured Than Used Flat

In recent years, improved techniques for handling curved honeycomb materials and producing contoured honeycomb products have reduced this once difficult task to simple, predictable practice. Discussed below are basic techniques for working metal and reinforced plastic honeycomb, after expansion.

Curving Metal Honeycomb



For simple curvature of constant or nearly constant thickness panels, the material is simply roll-formed through a standard sheet metal or Farnham roll. The principal consideration is that the opening between rolls must permit passage of the full thickness of the honeycomb core to prevent crushing. The technique of curving is to pass the honeycomb through the rolls using successively tighter radii until the final finished curvature is achieved.

Low density cores or tight radii require the use of metal slip sheets between the honeycomb and the rollers to prevent damage to the core surface. In some cases the outer slip sheet may be bonded temporarily to the honeycomb to facilitate achievement of extremely tight radii without any damage or opening of the cell structure on the outside surface. The temporary bonded slip sheet is peeled off after final rolling.

Compound curvature of metal honeycomb is achieved by either cross-rolling the parts or by over-forming and then using the anticlastic tendencies of the material to produce a radius in the cross axis by forcing out the radius in the primary axis.

Curving Glass Fabric Reinforced Plastic Honeycomb

Fiberglas honeycomb used in radomes and some primary structures requires a different curving technique than metal honeycomb. Since glass fabric core is a relatively brittle material, it must be preheated and held to contour during the cooling cycle. Preheat cycles of 500 to 600 degrees at 10 to 50 seconds are frequently used, with cooling cycles of one to two minutes at contact pressure in matched metal, plastic or plaster dies. Usually only a rough approximation of the finished contour is required since the contoured honeycomb is somewhat flexible and will readily conform to the exact contour of the bonding tool even though it may be slightly different than the finished honeycomb contour.

Carving Metal & Glass Fabric Honeycomb

Simple router tooling is all that is required for carving aluminum or glass fabric reinforced honeycombs. Cutter points may be either high speed valve stem cutters or an arbor of the same shape holding a jeweler's saw. In either case, cutter speeds from 4,000 to 15,000 rpm and extremely light tool point loads are normal.

A primary requirement for the carving machine bed is that it must be suitable for producing parts to plus or minus .005 dimension tolerances. As much as five to ten square feet an hour can be carved on simple shapes. In specialized applications, carving rates ten times this have been accomplished.

Hexcel Experience, Specialized Tooling Available To Help Designers

Hexcel's pioneer role in the development of honeycomb has resulted in the design and use of many special machines for precurving and machining unusual shapes. These facilities are available to work for you; or, Hexcel engineers will work with you in manufacturing your own forming and carving equipment from Hexcel drawings, and stay in your plant until your own employees are trained in our proven techniques for working honeycomb. Write Dept. D-12 or call for any specific information.

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NEW BOOKS

THE UNITED STATES TO 1865 and THE UNITED STATES SINCE 1865 present a two-volume history in particularly easy-to-read form. The first volume, authored by Michael Kraus, begins with events in Europe leading to the discovery of America. This is followed by chapters describing the discovery and settlement of America, the colonies in the 18th Century, the struggle for more freedom, the birth of the new free nation, the young republic, the growth of democracy, events leading to the Civil War, the preservation of the union and the death of Lincoln. The second volume, by Foster Rhea Dulles, covers the history of America from the surrender at Appomattox and the reconstruction period. This leads to an interesting account of the westward movement, the growth of industry, agriculture and labor. The emergence of cities and changes in the American way of life through the years are well portrayed. The political history of the United States from the Lincoln through the Eisenhower era is interestingly written. The book also discusses economic changes over the years, American participation in world history and the threat of Communism through the 1950's. The University of Michigan Press, Ann Arbor, Mich.; Vol. 1, 529 pages; Vol. 2, 546 pages; $15 per set.

CREATIVE ENGINEERING ANALYSIS. This is a book aimed at stimulating the isolation of problems and their solutions through a creative approach to engineering. Compared with most engineering texts, it provides a refreshing approach. The author assumes rightly that the really creative and necessary portion of engineering is recognizing problems for what they are and then solving them systematically. He starts first with a universal technique for problem solving that contains six definite steps, beginning with recognition and definition of the problem. He continues with a chapter on aids to problem-solving in general, such as use of free body diagrams and iterative solutions. The remainder of the book consists of problems in the three major fields of mechanics, strength of materials, electricity and electronics. Answers to all problems presented are given in an appendix. Because of its unusual approach, this book is particularly suited for review even though it is intended primarily for teaching. By Frederick L. Ryder; Prentice-Hall, Inc., Englewood Cliffs, N.J.; 282 pages; $9.

PATENTS FOR MANAGEMENT. In the words of the author, "The purpose of this handbook is to alert management to the principal dangers in the business use of patents, so that they can avoid their unintentional misuse and to indicate when management should consult patent counsel." Written in nonlegal language, this 72-page book is probably of most value to the management of smaller firms that do not have the benefit of patent counsel as part of their company organization. The book describes many phases of patent problems. Typical subjects covered include: "Organization and Functions of a Patent Department", "Patent Rights of Employee and Employer" and "The Role of Patents in New Product Development". Advance House Publishers, Box 334, Ardmore, Pa.; $5.50.

TUBE SUBSTITUTION HANDBOOK, Vol. 3, by Howard W. Sams Engineering Staff. This publication is designed for use by radio and television servicemen. It provides a ready reference manual among tube types and their possible substitutes. One section lists industrial tubes which may be used instead of standard receiving tubes to upgrade service. European substitutes for American types and conversely, American substitutes for European types also are included. The last section lists television picture tubes and their possible substitues. Warnings are included for those cases where a direct substitution is not possible. In the television tube substitution section a system of footnotes is used to warn where changes in installation may be necessary. Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind.; Catalog No. TUB-3; 96 pages; $1.50.

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This new engineering bulletin leads you right to the hydraulic pump designs you may be looking for. Here, passing on parade, are high performance gear pumps made to the measure of the next generation in aircraft, missiles, spacecraft, and support equipment.

Many of these units are the product of ready-made, mass-produced components that can be teamed into the precise configuration you need. Custom-designed pumps are also available.

All have in common these classic Eastern hydraulic pump characteristics:

SMALL SIZE: Eastern gear pumps are the smallest, lightest made. Airborne servo system pump shown delivers 1.5 gpm @ 1500 psig — measures only 1⅞" x 1⅞" x 2¾", weighs 9 oz.

WIDE PERFORMANCE RANGE: pumps available have theoretical displacement from .0016 to 1.30 cu. in. per revolution — flow from .025 to 9.6 gpm, pressures from 0 to 2000 psig, at speeds to 24,000 rpm. Weights with motor range from 1.5 to 8.5 lbs.

UNAFFECTED BY EXTREME ENVIRONMENTS: rugged, reliable Eastern units take loads to 50g in stride — shrug off temperature differentials to meet MIL specs.

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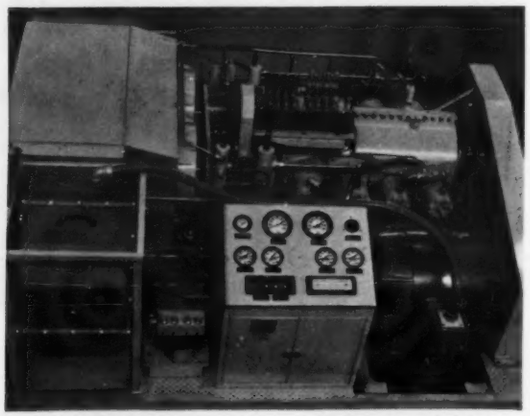

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For either testing or production, it may also be used as a central high pressure source for diverse locations, with Cardair supplying the complete system.

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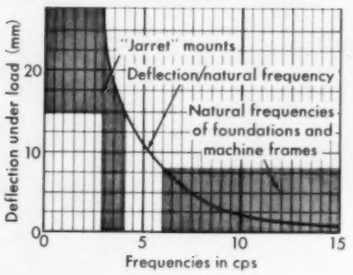
DESIGN IDEAS IN THE NEWS

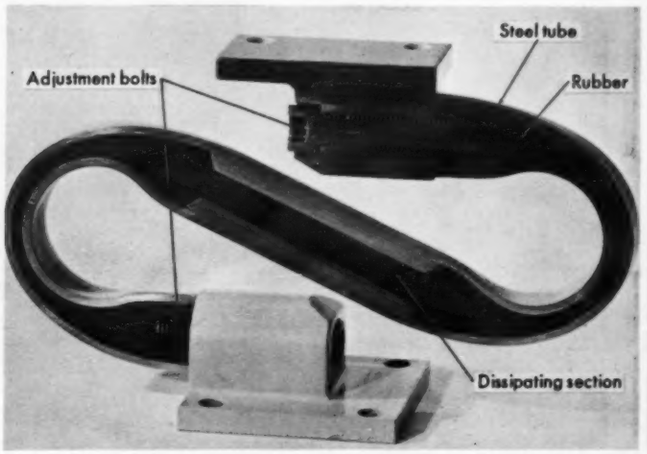
• **VIBRATION MOUNTS** utilize an elastomer under pressure in an S-shaped steel tube. They have a natural frequency between 3 and 4 cps, and deflection of 1.5 inches is possible. The pure spring action of steel is combined with the damping and energy dissipating effect of synthetic rubber compressed and flowing through restrictions. Intermolecular friction is said to absorb the energy, improving on common mechanical friction dampers which do transmit vibrations if the dynamic forces are less than the frictional forces.

Since the natural frequency of most machine frames and foundations ranges between 6 and 100 cps, no resonance problems exist. "JARRET" mounts are manufactured under French and foreign patents by Ets. Domange, Paris, France.

G.B.B.



DEFLECTION DIAGRAM shows natural frequencies of "JARRET" mount to be below those of machine frames and foundations. Manufacturer claims precision grinder can work within 30 ft of air hammer supported on such mounts.



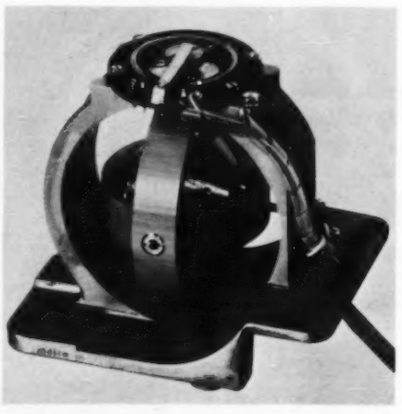
CROSS-SECTION of vibration absorber. Rubber in tube is under variable pressure, changed by turning end bolts in or out to vary characteristics. When mount is stressed, internal volume distribution changes, forcing rubber to flow through reduced-diameter center section.

• **PYROTECHNIC FREE GYRO** provides reliable attitude data for control of short-range missiles. Using an electrically ignited, solid propellant, the gyro achieves a start time of 0.1 sec maximum, with a cage speed of 36,000 rpm.

The device is uncaged electrically, requiring only 0.02 sec maximum. The use of a propellant charge allows construction of a gyro weighing only 0.5 lb and measuring 2-1/2 by 3-1/8 by 3-1/2 inches.

While currently providing roll, pitch or yaw attitude data for short-range missiles, the Pyrogyro also can be used for stabilization of longer-range missiles during the earlier periods of their flight.

The unit is a development of Giannini Controls Corp., Duarte, Calif.

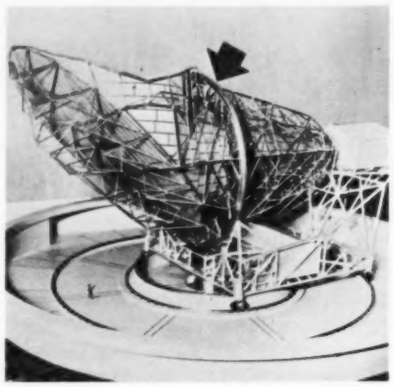


• **FORTY-TON STEEL WHEEL,** 70 ft in dia, turns a satellite communication antenna. Construction of the elevation wheel in a perfect circle, rigid and strong enough to support the 100-ton weight of the antenna horn, posed intricate engineering problems.

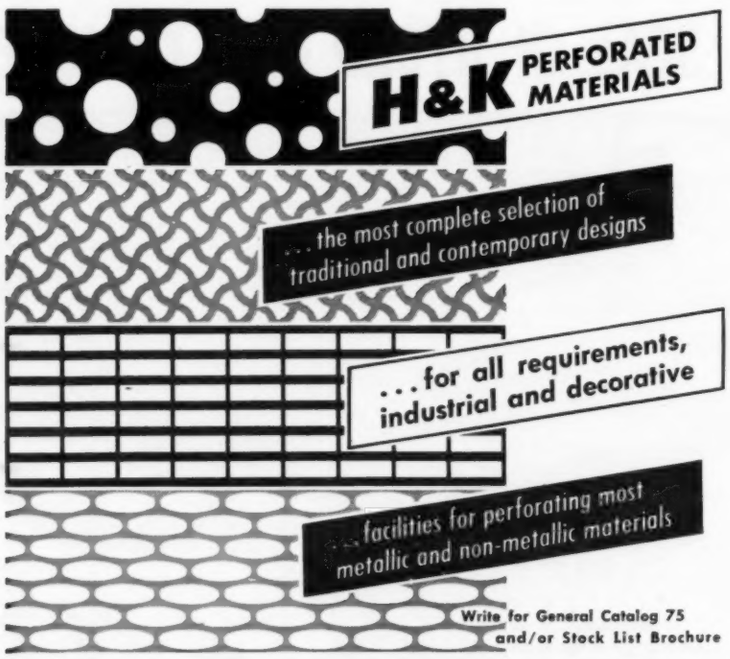
A series of concrete piers, topped by 1-inch-thick steel plates, was built to provide a level platform on which to fabricate the wheel. A special grinding attachment also was designed, consisting of a concrete column at the center of the circle with a 35-ft-long reinforced arm and cradle to hold the grinding head.

In operation, a pinion gear attached to the shaft of a stationary motor provides a direct drive to an immense gear mounted on the outside of the wheel. The outer edge of the wheel consists of a rail running in tracks to keep it in perfect alignment.

The wheel was constructed by McKiernan-Terry Corp., Dover, N.J.



MODEL of satellite communications antenna being built for the Bell Systems Project "Telstar" at Rumford, Me. Arrow marks 70-ft, 40-ton elevation wheel.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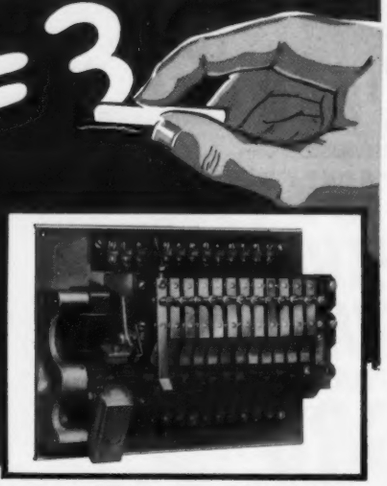

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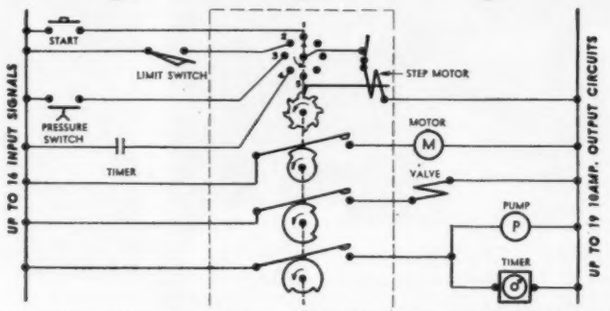
Start with THE BULLETIN 780 STEP SWITCH FOR STEP-BY-STEP SEQUENCE CONTROL

1 INPUT SIGNALS + 2 BULLETIN 780 STEP SWITCH = 3 PROGRAMMED SEQUENCE CONTROL

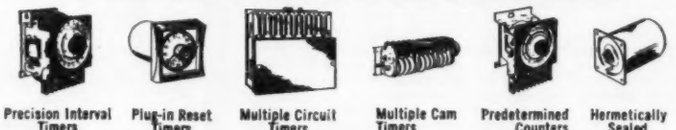
Closure of a control device, actuated upon completion of an operation, advances control to next position.

Circuits are opened or closed at each position or step according to preselected cam action.

Loads are interlocked thru step switch cams without complicated relay circuitry.



Write for Bulletin 780 or call your local Representative. He's listed in Sweet's Product Design File, Section 7d/EA, or in Thomas Register.



Precision Interval Timers | Plug-in Reset Timers | Multiple Circuit Timers | Multiple Cam Timers | Predetermined Counters | Hermetically Sealed Timers

MANUFACTURERS OF THE MOST COMPLETE LINE OF INDUSTRIAL TIME-COUNT CONTROLS AVAILABLE

BLISS

EAGLE SIGNAL COMPANY • Moline, Illinois
INDUSTRIAL DIVISION

A DIVISION OF THE GAMEWELL COMPANY, AN E.W. BLISS COMPANY SUBSIDIARY

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NEW TINY* PARTS GUIDE from GRC

Learn how GRC's special methods produce tiny zinc alloy die castings that can help you!

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*No Minimum Size! Maximum Sizes: 2" long, ½ oz.

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TROYFELT, a non-woven synthetic Dacron, gave best performance in military vehicle

To meet such rigid military filter specifications as 100% filtering efficiency in heavy dust conditions in sub-zero to tropical temperature extremes with resistance to oil, moisture, rot and mildew, sixty materials were tried and only one, Troyfelt, met the test as the filter on an engine intake air cleaner.

This success was due to Troyfelt's mechanically interlocked fiber construction. The absence of chemical binders or binder fibers prevents blinding and the structure gives Troyfelt unusually high, long-lived strength, excellent resistance to fungi and bacterial growth, chemicals, moisture, oil, abrasion, stability to temperature extremes.

Write for our bulletin describing other filter applications as well as applications on insulators, seals, padding, packings, gaskets and many others.

TROYFELT . . . *by the pioneers of non-woven synthetic felts*

INDUSTRIAL PRODUCTS DIV. • TROY MILLS, INC.

200 Madison Avenue • New York 16, N. Y.

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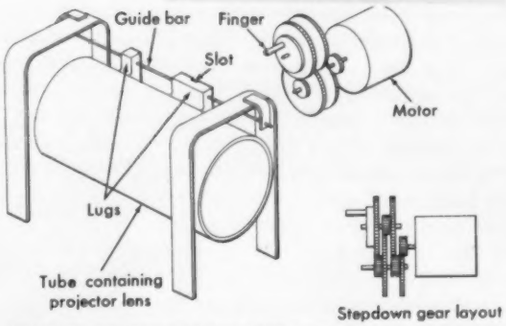
IDEAS IN THE NEWS



SIMPLIFIED SCHEMATIC SKETCH illustrates function of the focusing subgroup.

• **A NEW SLIDE PROJECTOR** permits remote-control, thumb-switch focusing in addition to push-button slide advance or reverse. A major advantage is that loose tolerance in slide mounting can be easily and accurately compensated.

The thumb switch is part of a small cable-connected hand-control unit. Sliding the switch from its central neutral position starts a small pole-reversing motor which drives a four-stage set of reducing gears. The last gear in the train has an off-center projecting finger.

The projector lens is mounted in a tube with cast-on lugs which are drilled axially to receive a guide bar. One of the lugs has a vertical slot engaged by the projecting finger. The resulting scotch-yoke action moves the lens as the motor turns. The large overall gear ratio permits precise focus adjustment.

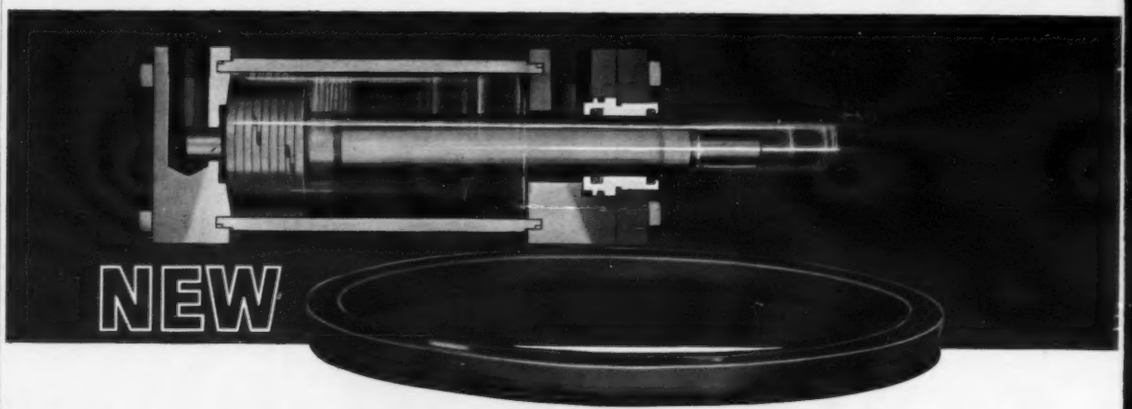
Standard projector lens is an f/1:2.5, 100-mm "Diatar", handling slides up to 38 by 38 mm format without vignetting. Optional lenses range from 85 to 150 mm focal length. The projector may be used with 300 or 500w lamps. Slides are prewarmed before entering the projection position, to prevent heat damage or loss of focus caused by thermal expansion.

A "Diatakt" accessory permits use of a canned tape soundtrack containing pulses for automatic slide advance.

The "Ikomat" projector, manufactured by Zeiss Ikon AG., Stuttgart, Germany, was included in the company's product family, recently awarded a gold cup by the "Comitè du Bon Goût Français" for outstanding industrial design.

R.F.S.

DURATON ROD SEAL IN HYDRO-LINE CYLINDERS



Here is a new opportunity to reduce machine downtime and costs caused by cylinder leakage or scoring: Hydro-Line's "Duraton" rod seal — exclusive durability formed from Fluorel®, guarded by backup washer of carbon-impregnated Teflon.

Leakproof seal is assured by superior resistance of "Duraton" rod seal-backup washer combination to abrasives, corrosives, and pressure. Retains effective resiliency at temperatures to 400°F and higher. Compatible with virtually all hydraulic fluids. Resists aging.

Iron-oxide-colored "Duraton" rod seals, Ebalon backup washers, and Fluorel wipers are standard on Hydro-Line Series N2 hydraulic cylinders to 5000 psi. See your Hydro-Line representative for details.

HYDRO-LINE

® Registered trademark of Minnesota Mining & Mfg. Co.

5603 PIKE ROAD, ROCKFORD, ILLINOIS, manufacturers of: high- and low-pressure hydraulic cylinders • heavy-duty air cylinders • boosters • adjustable-stroke cylinders • dispensing cylinders • single-acting cylinders • rod end couplers

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WATERMAN

Series 661
PILOT CHECK

Only 25% of line pressure required for pilot to open valve. Compact and light in weight. ¼" and ⅜" N.P.T.F., 3000 p.s.i.

Series 271
LOCK VALVES

Simple, positive, low-cost way to prevent cylinder creep due to leakage of spool valve. ¼" to ¾" N.P.T.F., 3000 p.s.i.

Series 56E
COUNTERBALANCE VALVES

Smooth, positive control of negative loads. Cylinder speed proportioned to pump output. ½" and 1" N.P.T.F., 3000 p.s.i.

Simplify hydraulic system design while you get improved performance. Why settle for halfway measures when you can specify a Waterman valve *designed* for these and other special purposes?

Send today for valuable Catalog 3001

NFPA

W-6118

WATERMAN HYDRAULICS CORPORATION

725 Custer Ave., Evanston, Ill.

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• **CLOSED-CIRCUIT TELEVISION** provides instruction simultaneously to 2000 Air Force officers in 165 viewing locations at the Air University Campus, Maxwell AFB, Montgomery, Ala.

The system can provide live, film, tape or off-the-air programs, or a mixture of these sources, to the student groups. It marks the first use by the armed forces of a compact television tape recorder designed especially for educational purposes.

A talk-back facility is included, enabling students in any of 155 classrooms to relay questions to the TV lecturer appearing before the studio cameras. Using a telephone-type handset, the student directs a question to the question controller who passes it to the instructor.

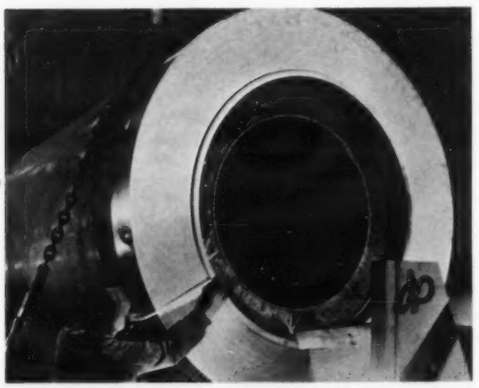
The system allows as many as six different programs to be selected for groups of classroom receivers serving the Air University's separate schools.

The installation was made by RCA.

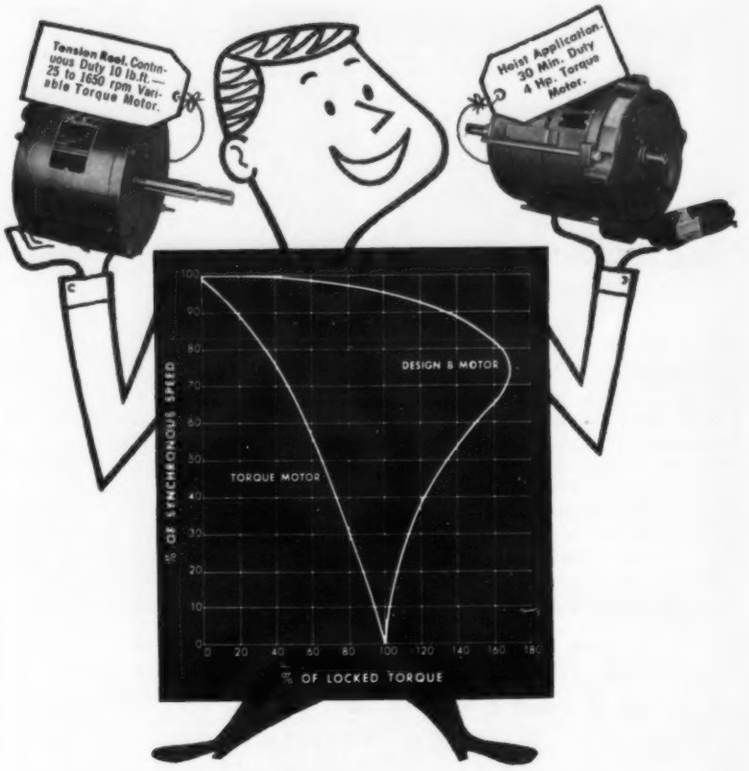
• **A PRESSURE VESSEL**, weighing 103 tons, is the heart of what is said to be the world's most powerful hydraulic press. Though rated at 41,000 tons, the direct-acting hydraulic press has delivered 63,000 tons during tests—a capacity never before equaled.

The multilayer pressure vessel used in the press was built by a process where relatively thin layers of steel were applied, one at a time, and progressively wrapped in a machine designed to obtain tightness between layers. By using a multilayer construction, it was not necessary to stress relieve the completed unit.

The pressure vessel was built by Process Equipment Div., A. O. Smith Corp., for Verson Allsteel Press Co. of Chicago and Dallas. It will be used in the forming of metal components in the manufacture of missiles and aircraft.



MULTILAYER PRESSURE VESSEL has an overall length of 16 ft, 6 inches, with a 56-inch ID. Thin steel wrap may be seen easily.


Tension Reel. Continuous Duty 10 lb.ft.—25 to 1650 rpm Variable Torque Motor.
Hoist Application. 30 Min. Duty 4 Hp. Torque Motor.
DESIGN B MOTOR
TORQUE MOTOR
% OF SYNCHRONOUS SPEED
% OF LOCKED TORQUE

Comparative Speed-Torque Curves of NEMA Design B Motor and Typical Torque Motor. The speed torque curve varies from that of a conventional motor. The torque motor curve is almost linear. Maximum torque occurs at the stalled position. For this reason, torque motors are used most often where a holding or resisting force is required.

When holding or resisting force is needed . . . TORQUE MOTORS from PEERLESS ELECTRIC

Motors for tension reel, hoist or those with brake, more often than not call for a special design. That makes Peerless one of your best sources. We custom build torque motors . . . will work with you to produce the *one* motor that powers your product for peak performance.

Or we may already have your torque motor in our line. It includes, among many others, a weather-proof and explosion-proof valve operator torque motor with brakes, 25 lb. ft., 15 min. duty . . . an explosion-proof torque motor with brake . . . a special flange mounting reversing duty hoist torque motor, single phase and 3-phase.

Take your pick, or state your special needs. We have many standard and special frame sizes; all types of mountings; class A, B, F, and H insulation. Ratings from 2 oz. ft. to 200 lb. ft.

Write for our FREE "New Torque Bulletin." Address: *Peerless Electric Division, H. K. Porter Co., Inc., W. Market St., Warren, Ohio.*

PEERLESS ELECTRIC DIVISION PORTER *H. K. PORTER COMPANY, INC.*

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

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Typical Fabroid
Self-aligning Bearing

BEARINGS
YOU
NEVER
LUBRICATE

Typical Fabroid
Journal Bearing

®FABROID BEARINGS CUT FRICTION 90%

Under severe helicopter test conditions, Fabroid bearings have gone 60,000,000 cycles *without* failure where all other bearings have failed at 50,000 cycles or less. In actual use Fabroid bearings are performing equally well. Yet Fabroid bearings *never* need lubrication!

Fabroid is a combined fabric of glass and Teflon* fibers backed by glass cloth impregnated with phenolic. The glass-phenolic system acts as a honeycomb which traps the Teflon and prevents it from cold flowing. The result is a bearing with 1/10th the friction coefficient of lubricated metal bearings.

Fabroid has limitless bearing applications where any or all the following conditions exist: lubrication is impractical; extreme temperatures; tight space or weight conditions; abrading, galling or corrosion; contamination; static friction; shock vibration.

E. I. Dupont's Tetrafluorethylene

SEND FOR this informative brochure which fully describes the functional characteristics of Fabroid.

MICRO-PRECISION DIVISION
OF
MICROMATIC HONE CORPORATION

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PHONE: ANgeles 3-6142

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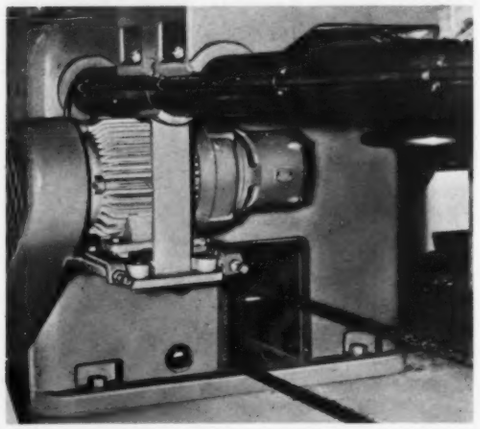
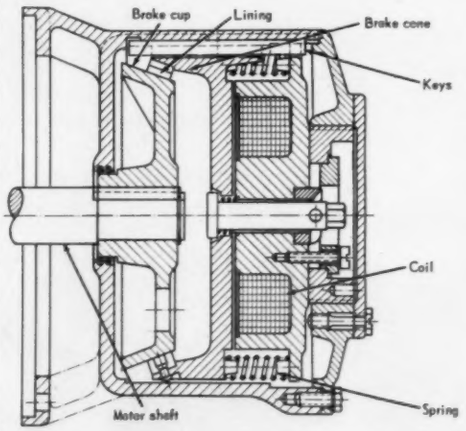
IDEAS IN THE NEWS

• **A NEW LINE OF MOTORS** has spring-loaded brakes which operate within 0.2 sec when brake coil current fails or is switched off. The brake design needs no axial movement of the armature shaft and includes both a simple electrical and mechanical release. Brake release occurs when the motor is switched on, which eliminates the thermal load resulting from standby electric braking.



CONE-TYPE BRAKE MOTOR drives feeder mechanism of machine for rough-turning of shafts.



CROSS-SECTION SHOWS cone-type brake for steady-current operation. Diametrically opposed keys absorb tangential forces during braking. Brake is released by direct current flowing through magnet coil, which disengages brake cone against spring pressure.

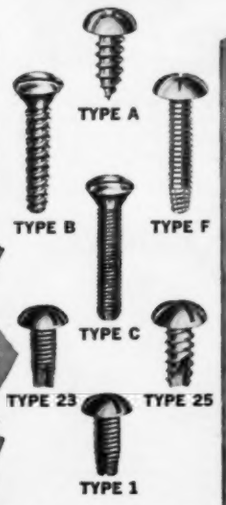
Brake power is supplied from a builtin transformer rectifier supplying 24v d-c. Brake springs act when the motor is switched off and the release coil is de-energized, providing a brake torque equal to twice the motor torque.

IT PAYS TO HAVE GOOD CONNECTIONS
HUBBELL

SECURE YOUR
PRODUCT QUALITY
with

HUBBELL

COLD HEADED — ROLLED THREAD
TAPPING AND THREAD CUTTING
FASTENERS



All types are uniform in size, heat treated to highest torque limits. They feature sharp, well-formed, full-bodied threads and deep, clean slots.

Sizes from #2 to ⅜". Finishes: nickel, cadmium, zinc, brass, bronze, chrome, Parkerizing, Iridite, blued.

For details, write or call—

KEY TO BETTER PRODUCTS AT LOWER ASSEMBLY COST.

HARVEY
HUBBELL
INCORPORATED
MACHINE SCREW DEPARTMENT
BRIDGEPORT 2, CONNECTICUT

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3 WAYS BETTER

ALBION'S NEW SERIES 16 CASTERS

Another completely new . . . completely practical Albion industrial caster series developed to serve a broader variety of applications. Conservatively rated as **medium duty** casters, yet constructed for longer, better . . . heavy duty, maintenance-free service. They're three ways better, and here's why:

1. MORE CAPACITY

The new Series 16 Casters offer Albion's finest, most dependable construction advantages such as "cold-formed" steel yoke base and top plate with heat-treated raceways for smoother, lasting maneuverability under greater capacity loadings.

2. MORE WEARABILITY

Albion's Series 16 Casters are available in nine different high capacity or floor protective wheel types in diameters of 3¼" to 8" with a capacity range of 140 to 900 lbs. per wheel. Sound engineering, quality materials and craftsmanship plus Albion's many outstanding construction features are combined to afford a caster that will last and last and last.

3. LESS COST

Although built to Albion's exacting quality standards, the Series 16 cost you far less than most ordinary casters of the same size or capacity ratings. And . . . they are available—all models—right now!

RIGID CASTERS
Albion's Series 16 Casters are available as matching rigid models in 9 wheel types—3¼" to 8" wheel diameters.

Remember . . . if you want longer, better service plus caster versatility at a savings you can count —be sure to get all the facts and figures from Albion.

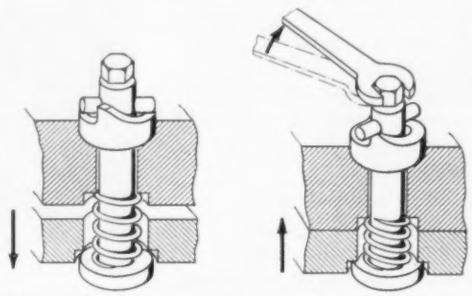
Write—wire or phone today for your copy of the new illustrated specification sheet on Albion Series 16 Casters.

ALBION INDUSTRIES, INC.
Albion Michigan

Circle 126 on Reader-Service Card

The cone-type brake motor is intended primarily for hoists and is available in horizontal or vertical mounting, rated to 55 lb-ft. Brake linings are said to last through 3 million cycles at 300 cph.

The motor is produced by Siemens-Schuckertwerke AG., Erlangen, Germany.



FOR MANUAL RELEASE, hex bolt is turned, forcing cross-pin to follow cam, compress spring and release brake cone.

• **PYROTECHNIC FLARES**, producing 150,000 candlepower, will burn under water for as long as 2 minutes. The flare is ignited by pressing a waterproof electric switch which fires a pyrotechnic squib, igniting the flare composition. The light source has been completely tested and used in underwater photography for exploration by demolition teams. It also has been used as an aid to underwater hull repair and similar applications. The flare is a development of Special Devices, Inc., Newhall, Calif.

Maxitorq

STANDARD

floating disc

single and double clutches or brakes

DESIGN PRINCIPLES OF THE 3 BASIC TYPES

The Maxitorq Clutch is completely assembled on the clutch body and shipped ready to slip onto a shaft. Separator springs . . . an outstanding feature . . . assure the advantages of truly floating discs. Used between each pair of inner discs, they spread them endways with an accordian action so that light can be seen between all discs when the clutch is in neutral. The floating disc feature makes certain that there's no drag . . . no abrasion . . . and consequently no heat when the clutch is in neutral.

A locking plate on the disc end of each clutch (two on the double types) locks all discs against tension developed by the separator springs. Manual adjustment is made by raising the lock spring, then turning the adjusting ring to give the desired shifting pressure.

Note that assembly adjustment and take-apart are all manual . . . no tools required.

Standard Maxitorq Clutches are available in single and double types, wet or dry . . . also in pulley and cut-off coupling types. Capacities to 15 h.p. at 100 r.p.m. Write Dept. DN for bulletin today.

Circle 127 on Reader-Service Card for more information

Gamma Rays Inspect Railroad Ties

A device for inspecting railroad ties for internal rot by measuring the backscattering of gamma rays emitted from a radioactive source has been developed for the New York Central System.

Use of the backscatter principle provides an instrument which requires access to only one side of a material, thus particularly suiting the device to the inspection of cross ties since only one surface is accessible. It also provides an instrument which can be adapted readily for inspecting both softwood and hardwood ties and can even be used to inspect the wood beneath steel tie plates.

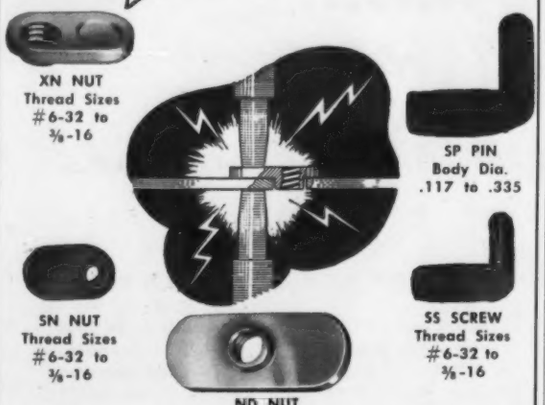
Basically, the instrument consists of an encapsulated radioisotope source, which emits gamma radiation, combined in the same housing with an energy-selective detector circuit.

In operation, the unit is adjusted so that the readings obtained are representative of only the wood in the tie. Adjustments are incorporated so that the radiation scattered back by the ballast and the iron spikes will not be recorded.

For a given material, the intensity of the backscatter and the resulting signal are both a function of electron density. Since a porous or rotted tie has fewer electrons available for interaction with the gamma radiation, a low reading results.

PROTOTYPE MODEL consists of single, compact package which houses gamma radiation source, detector and associated circuitry. Controls on top of unit allow calibration by operator in accordance with type of material being inspected.

OHIO SPOT WELDING FASTENERS



If you do spotwelding you can attach OHIO Spotweld Fasteners at the same time for faster, trouble-free assembly.

Samples and information available upon request.

The Primary Fastener in Fastener Assemblies

THE OHIO NUT AND BOLT CO.
29 FIRST STREET BEREA, OHIO

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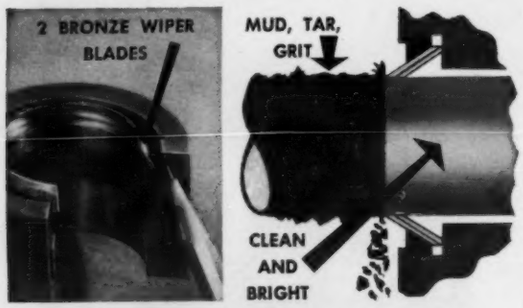

SEAL-GUARD®
keeps dirt, grit, water outside your cylinders

SEAL-GUARD keeps hydraulic and pneumatic systems clean—protects rods and packings—saves hydraulic fluids. Two bronze blades scrape rod clean and throw off foreign matter as rod enters cylinder. Rubber retainer ring absorbs shock, keeps blades in full contact with rod and provides an over-all outside seal. Compact, efficient, economical. Write E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Houghton
INDUSTRY'S PARTNER IN PRODUCTION

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Decco® INDUSTRIAL SOLENOIDS give you dependability and top performance!

- High moisture resistance
- Shock mounted for longer life
- 2 to 30 pounds—push or pull
- AC or DC models
- Compact design
- Quality built
- Industrial quality Miniatures

A model for every need. Special solenoids engineered to your needs.

DETROIT COIL COMPANY 2435 HILTON ROAD, FERNDALE 20, MICHIGAN

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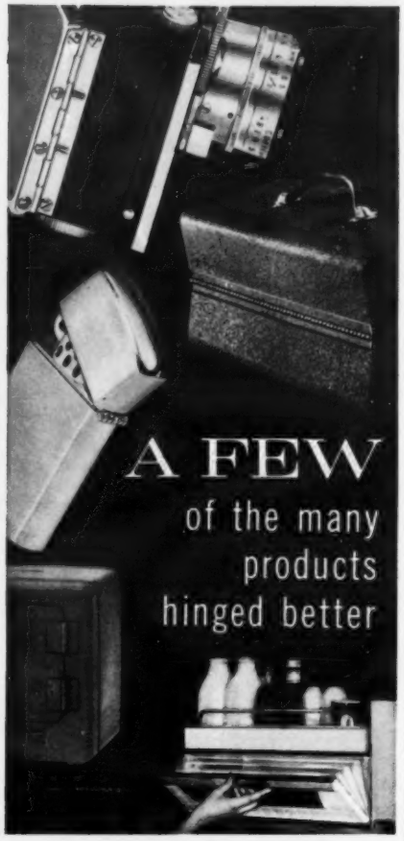


by Wagner

Hinges for every application
write -- no obligation

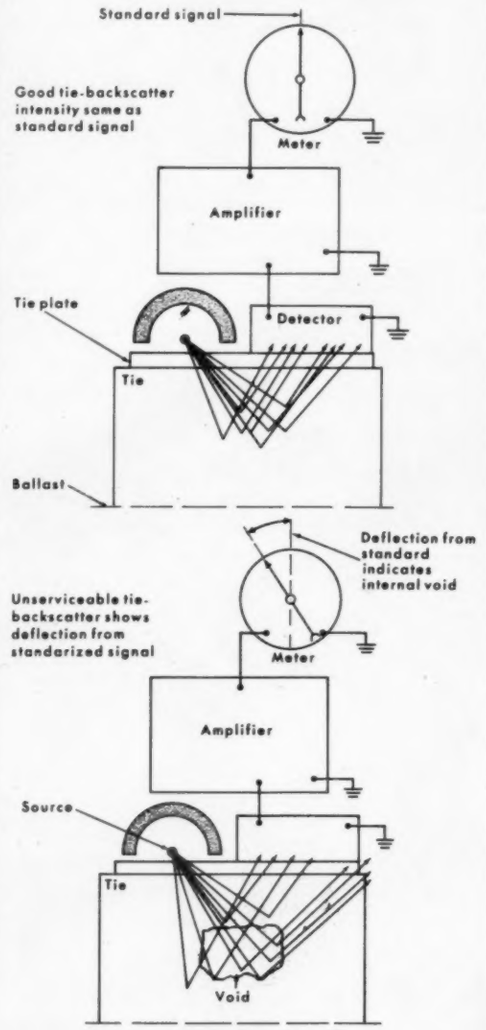
E. R. WAGNER
Manufacturing Co.
4613 N. 32 St.
Milwaukee 9, Wis.

Wagner

Circle 131 on Reader-Service Card

In the prototype, hand-carried model, a direct-reading dial is used to record signal intensity. In future automatic mechanisms for tie inspection, in which four such detectors would be employed simultaneously, a change in signal intensity of any one unit would cause an automatic marking device to be activated. The device would pinpoint the faulty tie with a visible mark for reference of following maintenance crews.

This instrument has provided a solution to the long-standing problem of inspecting ties by visual or audible methods. These previous methods of



SCHEMATIC shows how gamma radiation from radio-isotope source is scattered by electrons in material under inspection. Circuit is adjusted electronically to limit signal from scattering by surrounding materials to provide readout which is proportional to tie thickness. Voids or other variations in density caused by rot decrease intensity of signal, indicating tie is unserviceable.

(Continued on next page)

PRODUCT APPLICATION

HANSEN
SYNCHRON
TIMING MOTORS

Schulmerich
electro-mechanical
CARILLONIC BELL
systems . . .

Hansen SYNCHRON motors, the "heart" controlling the split-second timing of Schulmerich Carillonic Bells

SCHULMERICH CARILLONS, INC., world's largest manufacturer of electro-mechanical carillons, uses Hansen SYNCHRON Timing Motors to drive the program clock governing the all-automatic operation of these precision, perfect-tone instruments. Clock programming is offered at 15-minute intervals, 24 hours a day, 7 days a week. Scheduled to play at specified times, exactly to the minute — there is no allowance for plus or minus variation.

HANSEN SYNCHRON TIMING MOTORS were selected as an integral part of Schulmerich Carillonic Bells because they outperformed all other motors tested. Carefully controlled testing was based on four specifications: (1) instantaneous starting, (2) no time loss or gain, (3) absence of malfunction, and, (4) reliable, continuous operation for periods of a year or more. Depending on installation, motors operate at either 110 or 220 volts — 50 or 60 cycles.

SEND TODAY for informative folder containing specifications and technical data on all Hansen SYNCHRON motors and clock movements.

HANSEN
MANUFACTURING
COMPANY, INC.
PRINCETON, INDIANA

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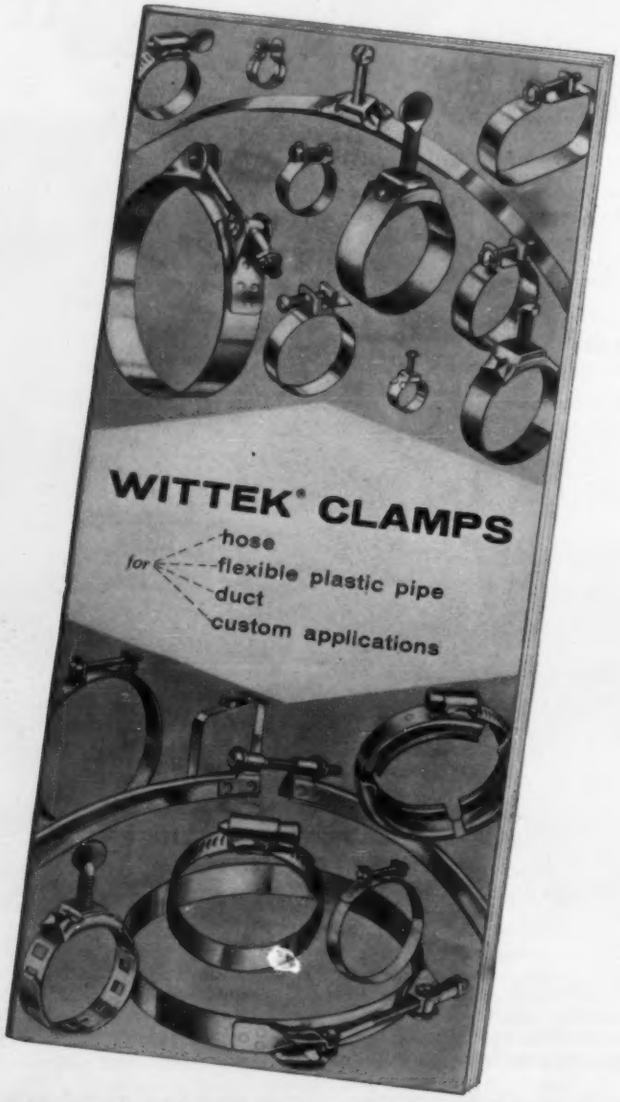
ELECTRIC MOTOR ENGINEERING, INC.
Los Angeles, Calif. — (OLive 1-3220)
Oakland, California
WINSLOW ELECTRIC CO.
New York, N.Y. — Essex, Conn. (SOuth 7-8229)
Philadelphia, Penn. Cleveland, Ohio

Sweet's Product Design File

Circle 132 on Reader-Service Card for more information

WHAT'S YOUR CLAMPING PROBLEM?



WITTEK has the answer . . .

Whatever your clamping problem, it's a safe bet that Wittek has the exact type and size clamp to do the job. Write for this new 16-page brochure on standard Wittek clamps and custom-made clamps.

Quality Clamps for Over 35 Years

WITTEK Manufacturing Co.
4350 West 24th Place, Chicago 23, Illinois

CLAMPS for Every Application

9566

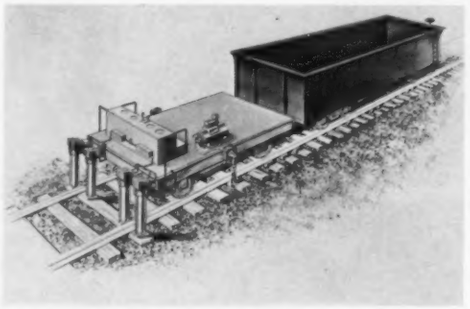
Circle 133 on Reader-Service Card for more information

IDEAS IN THE NEWS

inspection were approximately 50 percent accurate and required time-consuming manual procedures. The new device will eliminate these shortcomings and will allow the use of economical, programmed maintenance procedures.

The device also is adaptable to other industries where a measurement of density is required to determine quality or thickness. It was developed by the Cleveland Technical Center, Inc., Cleveland, Ohio, a wholly owned subsidiary of the New York Central Railroad Co.

E.J.S.



AUTOMATED DEVICE using this detector would scan ties in passing, marking those found to be unserviceable.

• **MOVING MAGNETIC FIELD** separates fine-grained ferrous particles from impurities in a novel device. Effectiveness of conventional separators is limited, since, in magnetic fields, iron powder tends to form clusters which can enclose impurities and drag them along. The new separator causes individual ferrous particles to rotate, breaking up clusters and significantly increasing separation efficiency.

Particles grouped in an elongated aggregate reduce the potential energy of a magnetic field more than individual, separated particles. Iron-containing clusters on a surface can be broken up by moving a magnetic field underneath the surface. Particles try to align themselves with force lines passing through the powder, and hysteresis and eddy current effects add to the rotating moment.

Minimum frequency to begin rotation depends on particle size; for 65-mesh magnetite particles, the limiting frequency is 50 to 100 cps.

In a typical model, a powder layer travels on a 400-mm-dia, 1-mm-thick drum of highly austenitic stainless steel. Drum widths up to 1200 mm are commercially available.

Power is supplied by a 1.5-kw motor which rotates the drum at 400 rpm. Within the drum a 36-pole wheel turns at 800 rpm with 0.5-mm clear

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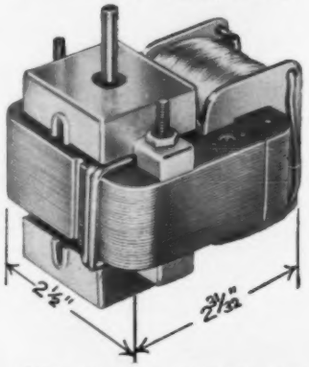

MODEL "H" 2-Pole, Shaded-Pole Motor 1/550 to 1/90 H.P., designed and constructed with features that assure thousands of extra hours of service under the most adverse operating conditions.

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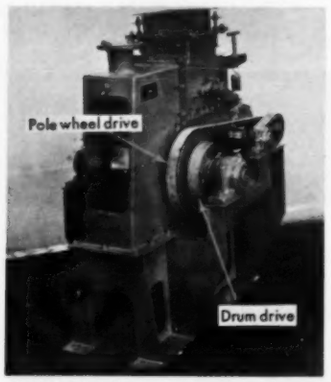
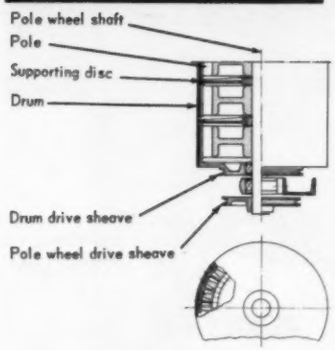
ance between poles and inside drum surface. Differential frequency is 120 cps, causing iron particles to roll on drum surface against the direction of drum motion. To protect the thin drum wall, supporting discs are spaced every 100 mm along the shaft of the pole wheel. Resulting separation is high. In a test it surpassed, in one stage, the effectiveness of a conventional wet-running magnetic separator, equivalent to three stages. Depending on material, capacities range from 7 to 15 tons per hour.

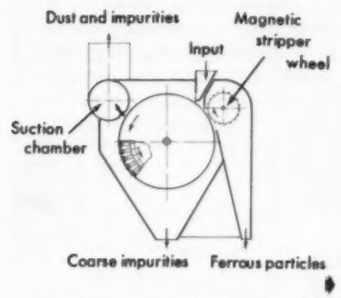
The separator was developed by Erkki Laurila, Helsinki, Finland, and is manufactured by Friedr. Krupp Maschinen-und Stahlbau, Rheinhausen, Germany.

R.F.S.





Drum and pole wheel assembly.



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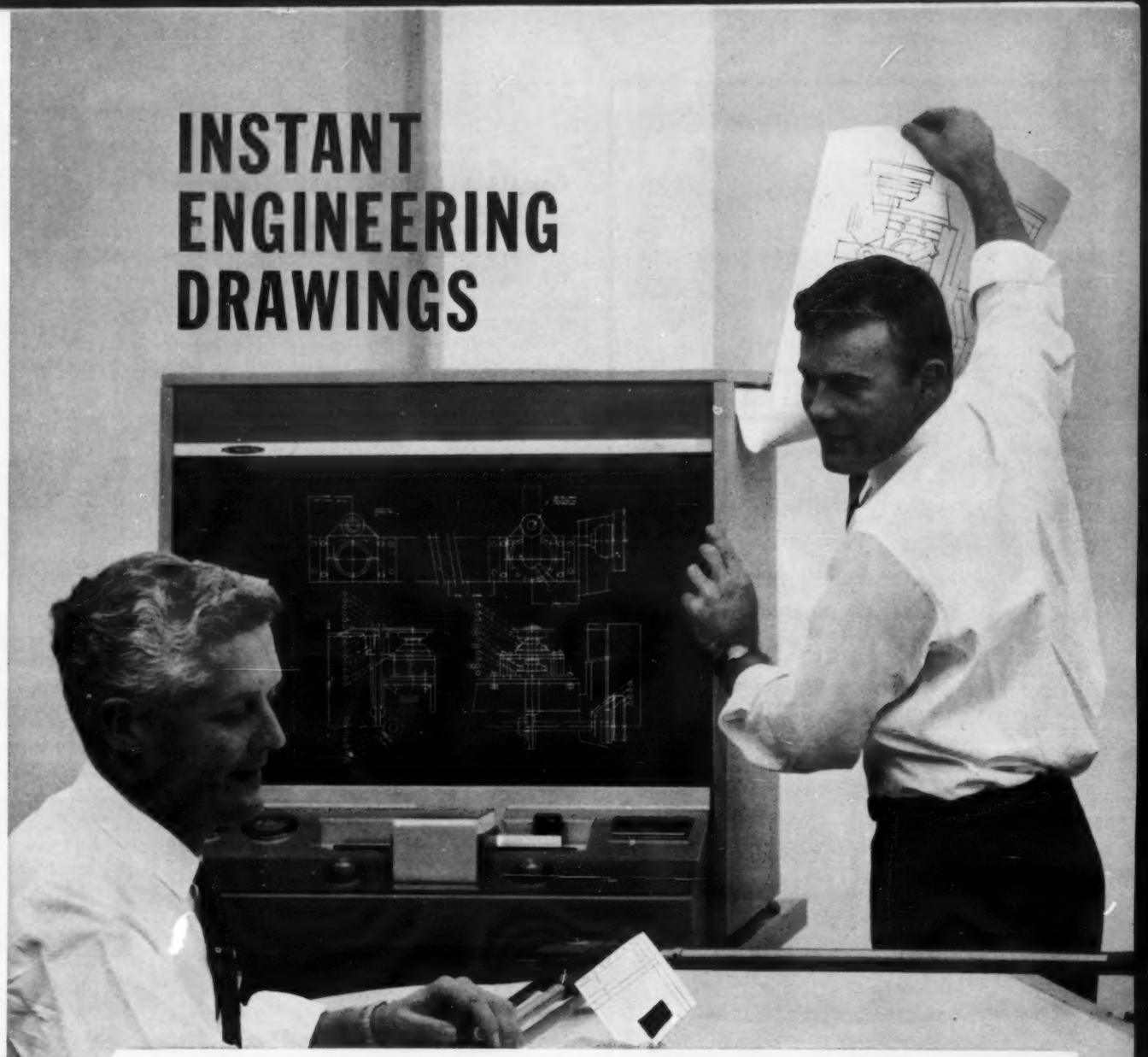
INSTANT ENGINEERING DRAWINGS



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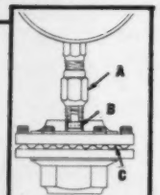

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IDEAS IN THE NEWS

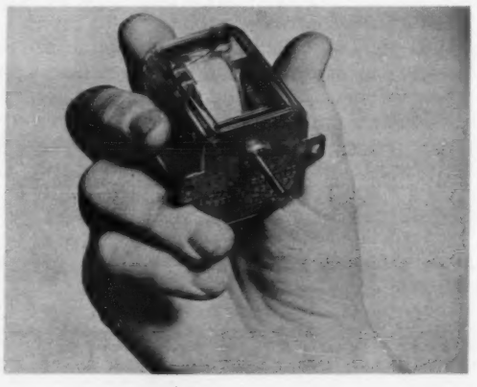
• **SMALL ELECTRIC MOTOR,** constructed around die-cast and molded parts, is available in three output shaft speeds of 1, 6 or 60 rpm. The motor develops 1/1000 hp, runs in either direction and operates on two flashlight batteries.

To derive output speeds of 1, 6 or 60 rpm, the driving pinion, depending upon its location, meshes with one of three gears. For the lowest output speed, the pinion meshes with the first train of three reduction gear and pinion combinations, developing a 1-rpm movement of the power gear. When a 6-rpm output is desired, the first reduction gear and pinion is eliminated and the properly placed pinion engages the second reduction gear and pinion. For a 60-rpm output, the entire reduction gear train is eliminated and the driving pinion in its third position meshes directly with the power gear.

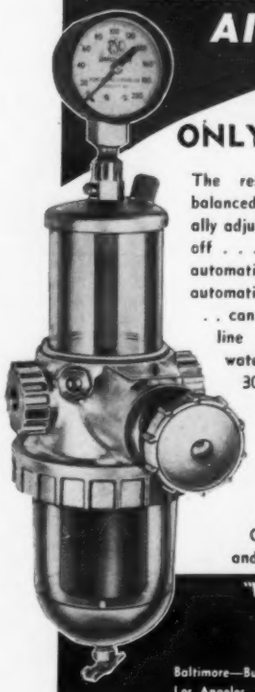
The armature is a small Alnico magnet rather than the usual wound structure. Each armature is broken from an extruded Alnico bar that is notched to the required lengths. After insertion in the die-cast magnet holder, the bar is secured in place by bending the holder tabs. The complete armature unit then is balanced dynamically.

To assure firm anchoring of the armature and a fixed relationship to the make-and-break cam, the cam and armature drive pinion, with journal trunnions, were designed to be integral with the magnet holder. The three components were die-cast as a one-piece unit, eliminating assembly cost and the possibility of improper alignment of parts.

The field winding is a simple elliptical coil whose axis is at right angles to the armature axis. The armature is centered in this coil so that the magnet alternately aligns with the field lies across the field, opposes the field and lies across the field again but in opposite polarity. A small interrupting switch, actuated by the make-and-break cam on the magnet holder, is



STREAMLINED AIR CONTROL



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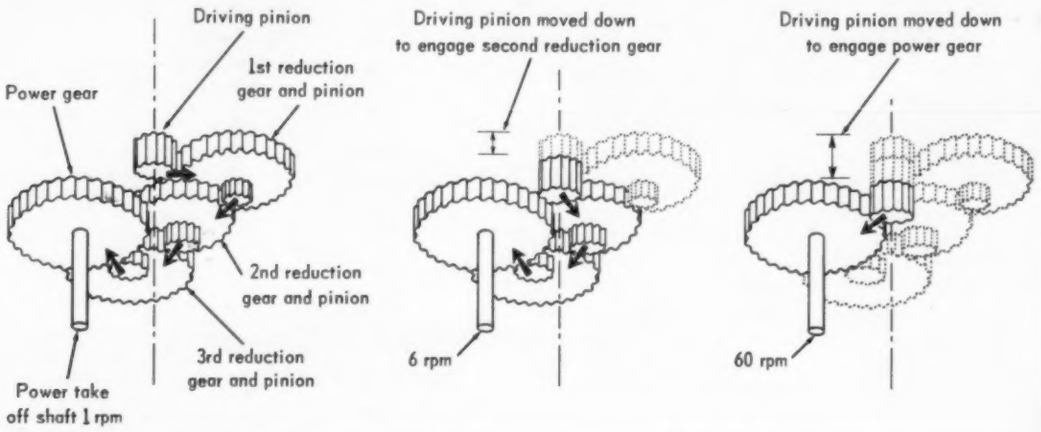
connected in series with the field to provide correctly sequenced magnetic pulses to keep the motor running.

Make-and-break contacts are bronze strips held in precise position relative to the cam by means of two nylon supports. The inner armature bearing is composed of phosphor bronze and brass strips, sandwiched together in such a manner that the radial load is carried in the brass portion while the bronze strip takes the thrust.

The motor was designed by Display Motor Div., Hankscraft Co., Reedsburg, Wis. Die-cast and molded parts were produced by Gries Reproducer Corp., New Rochelle, N.Y.

◆ **MOTOR is assembled with driving pinion at one of three locations indicated, depending on speed desired. Gears omitted from gear train are shown in dotted line.**


Driving pinion
Power gear
1st reduction gear and pinion
2nd reduction gear and pinion
3rd reduction gear and pinion
Power take off shaft 1 rpm
Driving pinion moved down to engage second reduction gear
6 rpm
Driving pinion moved down to engage power gear
60 rpm

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Uneven loads will not sway, tip or tilt because off-center load is evenly distributed on both springs. Variable ratio springing adjusts self to road conditions. Deflection rate changes automatically to produce exactly right capacity to properly balance spring tension with load. Lower center of gravity without sacrifice of clearance. Only four bolts to mount . . . no assembly required. Just two friction bearings with renewable friction inserts control spring action.

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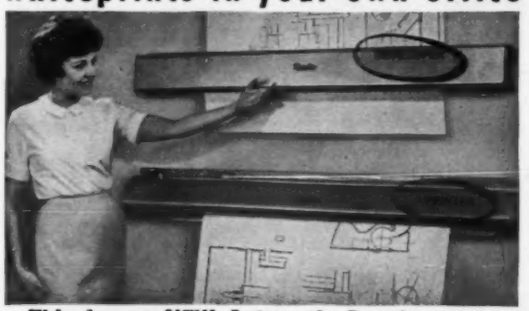

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IDEAS IN THE NEWS

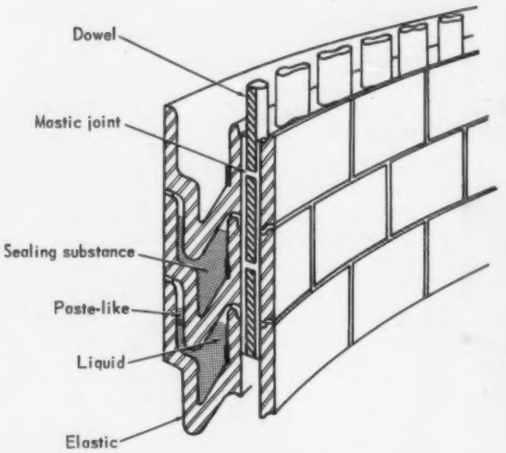
• **SPECIAL LIQUID** seals brick interspaces in an all-ceramic acid vessel. The sealing liquid prevents escape of liquid and gas up to pressures of 8.5 psig, temperatures of 392F. Advantages over ceramic-clad steel vessels are simplicity of design, low cost and absence of internal stresses caused by different coefficients of thermal expansion.

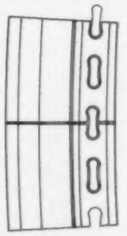
A special glazed-surface brick having a V-shaped cross-section forms an acute-angled gutter. Glazed vertical dowels with hourglass cross-sections are inserted into passages of the inside V-leg, locking individual courses together. The bricks are so designed that interspaces, resembling U-tubes, remain between courses.

These interspaces are filled with a special proprietary sealing liquid. Viscosity, density and composition of the liquid are selected for different operating conditions so that the material in the colder outside leg remains a paste-like solid, while it becomes liquid in the warmer inside leg.

"peteR" bricks, sealing material and tower design are developments of Steuler-Industriewerke GmbH., Hoehr-Grenzhausen, Germany.

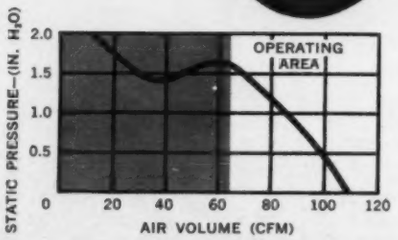
R.F.S.





Plan view of dowel arrangement

3" dia. x 3¼" long, 16 ounces



NEW VANEAXIAL

AC/DC UNIVERSAL BLOWER

Globe's VAX-3-GN Universal Blower gives you 110 cfm. free air, with a design point of 68 cfm. at 1.5" H_2O—on **either** 115 v.d.c. or 115 v.a.c., 60 cycle power. Other voltages can be supplied. Nominal speed is 14,000 rpm.

You can standardize on this extremely versatile blower for ground support and commercial electronic cooling. It's designed to meet MIL specs, having passed shock and vibration per MIL-E-5272. Production tooling makes this blower economical. Prototypes can be in your hands tomorrow (telephone BA-2-3741 for part no. 19A908); production orders normally delivered in a short time.

Rugged mechanical protection is provided by the black anodized aluminum housing and propeller. Mount by clamping to servo ring at either end. Nominal life exceeds 1000 hours. Max. current is 0.47 amps at free air delivery. Request Bulletin GNB from Globe Industries, Inc., 1784 Stanley Avenue, Dayton 4, Ohio.

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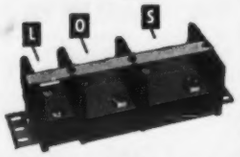
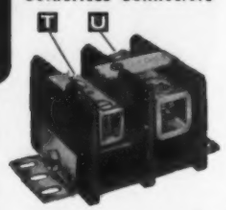
Terminal Blocks

Types "L", "O" and "S"
for Wires or Cables with lugs.



- Nickel plated copper terminal bars for good conductivity.
- Type "L"—750 Volts 100 Amp. Capacity, for up to AWG No. 1 wire—1 to 12 terminals.
- Type "O"—750 Volts 125 Amp. Capacity, for up to AWG 1/0 wire—1 to 4 terminals.
- Type "S"—750 Volts 225 Amp. Capacity, for up to AWG 4/0 wire—1 to 4 terminals.
- White Fibre Marking Strips.

Types "T" and "U"
With High Pressure Solderless Connectors



- 750 Volt 125 Amp. and 250 Amp. Capacity.
- 100% pure electrolytic copper tubular connectors provide 100% conductivity.
- Wire clamping screws give positive and completely positioned connection.
- No expensive lugs—no lug assembly time required.
- Type "T" for AWG #6 to 1/0 wire, 1 to 6 terminals.
- Type "U" for AWG #4 to 250 MCM wire, 1 to 4 terminals.
- White Fibre Marking Strips.

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Scully-Jones and Company
1932 South Rockwell Street, Chicago 8, Illinois

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• **DIFFUSION DISTILLATION** begins to show promise as a method of making fresh drinkable water from contaminated supplies, including sea water or water containing radioactive fallout.

An experimental unit has been producing pure soft water, hot enough to use directly for laundry or dishwashing, from otherwise unusable sources at the rate of 200 gal per day. Engineers are hoping to have an advanced model ready for long trial runs next year to evaluate the design and to gain operating experience.

The device has several advantages over other distillation methods for low-capacity application. It works at normal air pressures and below the boiling point of water. It needs no operator and it has only one moving part.

The experimental unit is a cylinder 3 ft long and 2 ft in dia. Inside the cylinder is a horizontal shaft, having a number of discs mounted on it. A motor turns the shaft and the discs at about 1 rps, the bottom half of each disc being immersed in a pool of hot, incoming water.

The top half of each disc passes between hollow, cooled condenser plates. The rotating disc picks up a film from the pool and water molecules evaporate from the film and diffuse across the short air gap to the cool stationary plate. Here they condense into droplets of pure water and flow into collecting troughs.

Incoming water is circulated through the condenser plates first and warmed by the still's own heat to a temperature of about 200 deg. Fuel burners, or electric heaters, are needed only to boost the temperature to 210 deg. Power requirements are low—about 1/50 hp to turn the discs and to drive a circulating pump.

For home use a typical unit would operate around the clock, shutting off automatically when the storage tank is filled, starting again at any predetermined tank level.

Scale formation does not affect the still's efficiency because the heat transfer takes place between the water vapor and the clean condenser plates. Only after long periods, when scale has nearly filled the space between the disc and plates, would the unit need cleaning or disc replacement.

The still will process water that is brackish, heavily mineralized or polluted by organic matter. The water is pasteurized and softened as well as purified. Purity is not affected by varying amounts of solids in the salty or contaminated supply.

In addition to home use, the unit may have great potential for self-service laundries, motels, restaurants, hospitals, military field units and small boats.

The diffusion distillation still was announced by Dr. J. H. Hollomon, general manager of General Electric's Engineering Lab., San Francisco, Calif.

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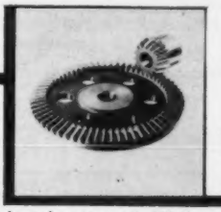

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Read or control tank levels, and pressure drops across filters, heat exchange orifices for flow metering, gas adsorbers and many other types of equipment. Learn more about the cost and service advantages of these units.

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PALL
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Solenoid Valves

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They're Types Q and Q-1 in all these sizes:
⅜" • ½" • ¾" • 1" • 1¼" • 1½" • 2"

Fully Automatic • Normally Closed • Packless
2-Way • Piston-Pilot Operated • Bronze Body

TYPE Q General purpose for air and water at pressures from 5 to 400 psi; temperatures to 250° F. . . . and steam at pressures to 15 psi; temperatures to 250° F.

TYPE Q-1 For steam at pressures from 5 to 150 psi, and temperatures to 365° F.

Coils of both types are guaranteed unconditionally for a full year

Write for FREE Bulletin on Our Full Line of Solenoid Valves!

TYPICAL USER NET PRICES • F.O.B. FACTORY

SIZE	TYPE Q		TYPE Q-1	
	1 to 5	100 to 499	1 to 5	100 to 499
⅜" or ½"	22.00	19.25	29.10	25.46
¾"	26.00	22.75	33.10	28.96
1"	35.00	30.63	42.10	36.84
1¼"	43.00	37.63	50.10	43.48
1½"	66.00	57.75	73.10	63.96
2"	84.00	73.50	91.10	79.71

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SETKO **Set Screw** & Mfg. Co.

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*Pat. 2,778,265 *Pat. Applied for 8231R

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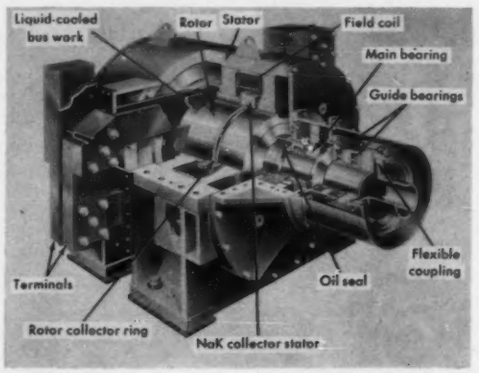
IDEAS IN THE NEWS

• **ACYCLIC GENERATOR** uses a liquid-metal collector system instead of sliding brushes for very high direct-current generation. The new machines are termed "acyclic generators" because they generate direct current without commutation. By contrast, conventional commutator-type machines generate alternating current and rectify it by means of a commutator to comparatively low-current, high-voltage, d-c power. Acyclic generators were demonstrated early in the 19th century by Michael Faraday. He made a simple demonstration by passing a bar of copper between the poles of a horseshoe magnet and observed that a potential difference was developed between the two edges of the bar under the magnet. He later applied this principle to a rotating disc passing through the field of a horseshoe magnet. The d-c voltage generated between the shaft and the rim then was impressed on an external circuit by using sliding brushes. The "homopolar" or "unipolar" machines, as they are known, have had little industrial application because of their complex sliding brushes, high maintenance and high losses. In the new acyclic generator, built by General Electric's Large Motor and Generator Dept. at Schenectady, N.Y., the rotor is of solid steel integral with the shaft. A liquid-metal eutectic of sodium and potassium replaces the sliding brushes in the collector system. The eutectic circulates between the rotating and stationary parts of the collector. It is a liquid from 10F to its boiling point of about 1400F. It weighs only 85 percent as much as water and has low viscosity, allowing its use at high peripheral velocities without high viscous losses. One of its useful properties causes it to "wet" the collector surfaces at low temperatures, essentially welding the rotating and stationary parts of the collector together, aiding its current-carrying ability. Because the liquid metal oxidizes rapidly



CUTAWAY VIEW of acyclic generator; 3600 rpm, 150,000 amps, 67v d-c, 10,000 kw.

Need Help with HIGH PRESSURE PROBLEMS?

3000 PSI to 15,000 PSI

Star HI-LO Two Speed Manual Hydraulic Pump operated by single lever.

Hydraulic Pumps, Cylinders and Rams — one or a hundred — rugged precision machined units designed, adapted or built to your drawings or performance specifications. *Star* quality is the reason Star units are integral in many high-performance machines.

Qualified Star Hydraulic Engineers are available to help you. Send us your pressure problems. We will present recommendations and a proposal based on your requirements.

Write for Bulletin 160.

STAR HYDRAULICS, INC.

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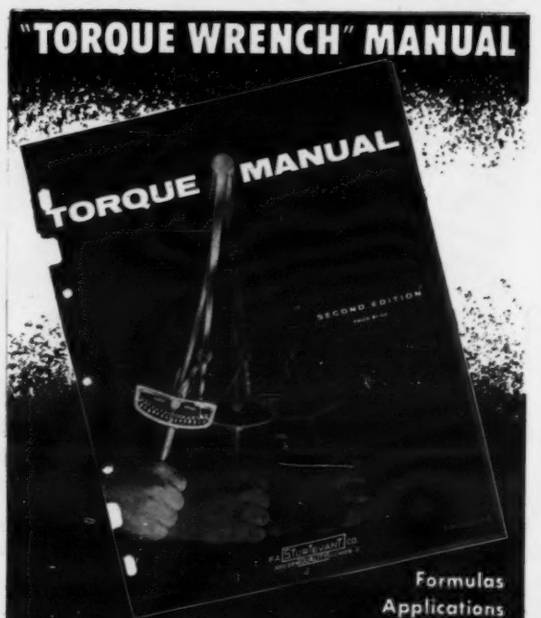
"TORQUE WRENCH" MANUAL



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Formulas
Applications
Engineering Data
Screw Torque Data
Adapter Problems
General Principles

PA STURTEVANT CO. ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

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(Left) plain type. (Right) with longitudinal positioning nuts. Both are shown with BLANK SPINDLE END for machining by user.

Gilman
CARTRIDGE-TYPE
SPINDLE ASSEMBLIES

. . . available from stock in **28** *standard types and sizes*

AVAILABLE in plain cylindrical type or with longitudinal positioning nuts. Five types of spindle noses are offered. Range of cartridge diameters from 1.250" to 2.750".

Design Advantages

- Steel spindles are precision machined and ground, with close tolerances maintained throughout.
- Matched, double-row ball bearings at tool end of spindle . . . single-row ball bearings at the driven end.
- Positioning nuts are graduated in increments of spindle adjustment of 0.001".
- Spindle assemblies can be mounted in a bored hole or in Gilman precision mounting brackets.

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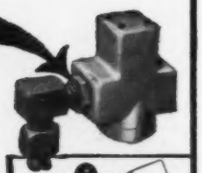
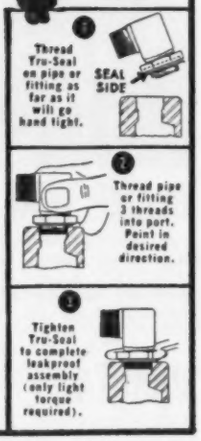
TRU-SEAL
TEFLON SEAL
PAT. PENDING

Saves hours in piping installations



Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.


1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION
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"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

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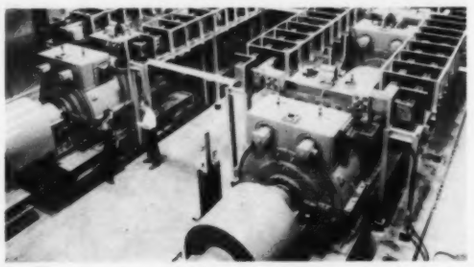
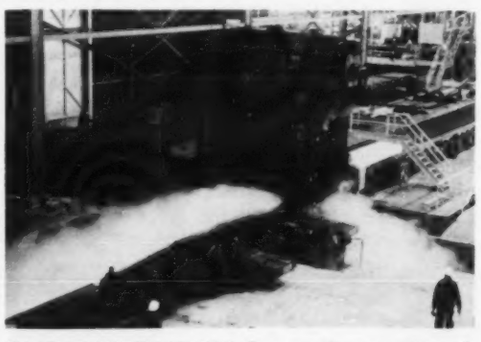
in air and reacts with water, the generators are enclosed and filled with pure dry nitrogen at a slight positive pressure. Oil seals around the shaft exclude oxygen or water vapor. The acyclic generator can be directly driven by a turbine or a motor. The machine is particularly useful in supplying large blocks of high-current, low-voltage, d-c power. It offers significant first-cost savings and operating economy. In electrolytic process applications, such as an aluminum-pot line, the requirements might be 150,000 amps at 400v. Six acyclic generators, each rated at 150,000 amps, 67v, could be driven by a steam turbine. A typical chlorine-cell line rated at 150,000 amps and 134v could be served by a two-unit set in series. Power supply for particle-accelerator magnets and generators for pulse duty are still other applications.

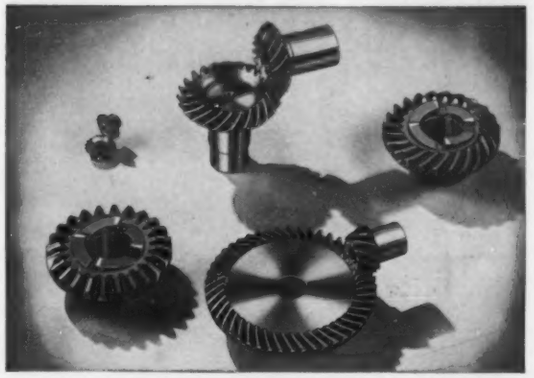


FOUR ACYCLIC GENERATORS installed at U.S. Air Force's Arnold Engineering Development Center at Tullahoma, Tenn.

• **SOLID-STATE DEVICES** replace the conventional relay type of electrical-mechanical control in the control system which governs the main drive in this new 110-inch plate mill. The static components increase reliability and speed of operation of the system, minimizing maintenance problems. Drive equipment for the mill includes two 4000-hp d-c motors capable of rolling steel plate through the mill at a maximum rate of 754 fpm. The semiconductor control system was part of a $36 million expansion program, including a 40-inch blooming mill and a 110-inch plate mill placed in operation by the Alan Wood Steel Co., Conshohocken, Pa.



FLAT SURFACE PLATE shown as it passes through semiconductor controlled mill. Steam is from water applied under high pressure to remove scale.



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WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF FRACTIONAL HORSEPOWER GEARS

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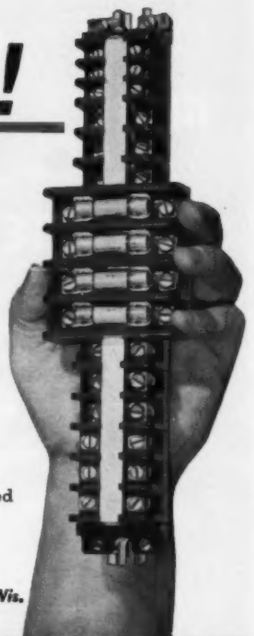
More Flexible!

SQUARE D *FUSIBLE* TERMINAL BLOCKS



- INCREASED FLEXIBILITY... individual fusible blocks combine with four different types of terminals on a single channel.
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- Accepts any ferrule-type fuse 13/32" diameter by 1½" long
- Available in factory-assembled units, or kit form for customer assembly

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PRECISION CONTROL

This Zero-Max screw control gives exact speed settings. It is one of many options from the standard lever type control.

Zero-Max drives deliver constant torque, are truly stepless—zero to maximum—available with instant reverse and neutral. They are low cost, small in size but big in power and performance. Over 30 basic fhp models (1/15 to 3/4 hp) carry torque ratings of 3 to 450 in. lbs. and speed ranges to 0 to 1200 rpm. Drives come with or without motors and gearheads.

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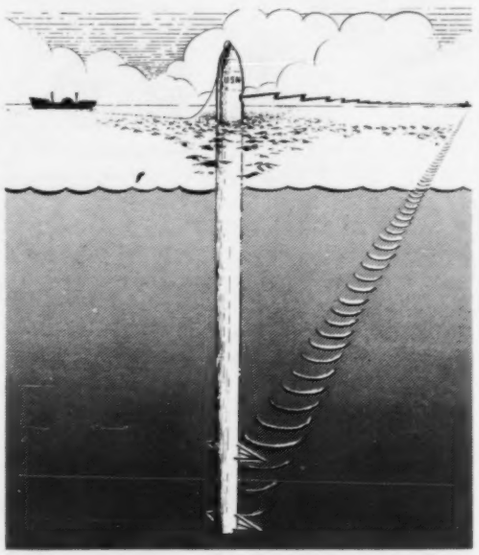
• **FLOATING ON END,** this 350-ft-long unmanned research vessel will serve as a stable platform for conducting acoustics research. Designed for use in the comparatively rough seas of the Atlantic Ocean, the vessel will measure the speed and intensity of underwater sound transmission at depths to 300 ft in various parts of the ocean. Essentially a 16-ft-dia steel tube, the vessel has a displacement equal to that of a World War II submarine. On the exterior of its hull are attached sensitive underwater listening devices, thermometers, pressure gages and instruments for determining the amount of salt in the surrounding sea. Ballast and free-flood tanks make up the interior of the lower 280-ft section, while operating machinery and additional instrumentation are housed in the upper 70-ft buoyancy section. The instrumented research vessel is called SPAR—Seagoing Platform for



NAVY'S SEAGOING PLATFORM for acoustics research, called SPAR, is shown in its listening position as it receives both underwater sonar and radio signals from ship pictured on the horizon at right. On the left is SPAR's tow ship, leashed to the research vessel by a half-mile of power supply and tow cables.

STANDS ALONE!

Type SN Johnson ROTARY PRESSURE Joint

There's not another rotary joint like the Johnson Type SN. Used where inlet or outlet pipe must rotate with the roll—on certain paper machines, drilled rolls of rubber or plastic mills and calenders, double shell dryers, and the like. Needs no external supports of any kind. Like all Johnson Joints the Type SN seals without packing, needs no lubrication or adjustment.

Investigate Johnson Joints for all steam-heated or water-cooled rolls. Handle Dowtherm, Monsanto Aroclors, hot oils too. Sizes to 8". For data on Type SN write for Bulletin N-2002.

THE JOHNSON CORPORATION
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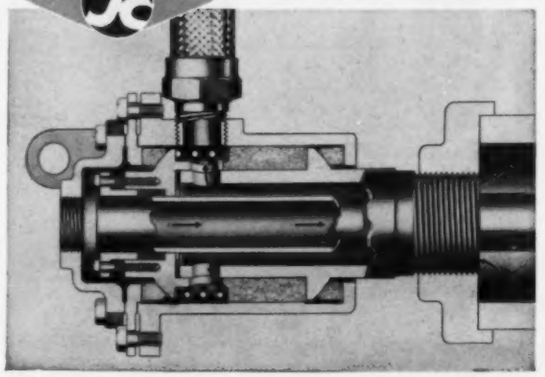

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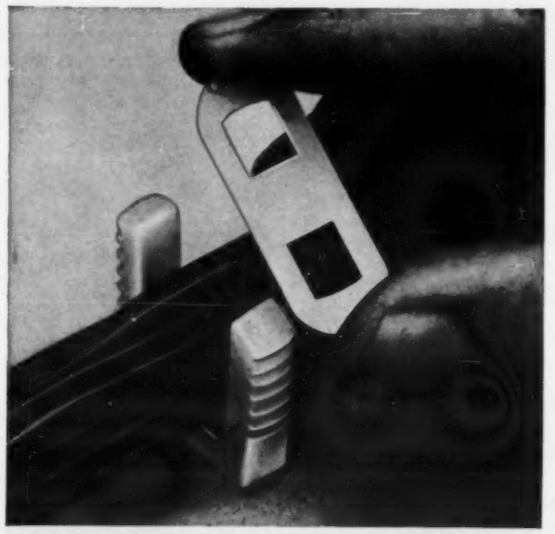

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Just place wire bundle inside "U," push keeper down snugly, and this light-weight clamp is securely locked to withstand loadings greater than 50 G's! A Cab-L-Tite* clamp securing 58,000 mils weighs only 0.016 oz.; 8,570,000 mils, 0.832 oz. Proved in aircraft and missiles, Cab-L-Tite* is made of tough DuPont zytel, which meets MIL-P-17091. Removable in seconds for rerouting wires. Write for free literature. *Manufacturer of Bund-L-Tite straps.*

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If you have a gear problem, check with Fairfield. Our engineers are well-qualified to give you expert recommendations. *LARGE or SMALL, your requirements will receive prompt attention.* CALL OR WRITE.

SPUR GEARS—Straight, helical, and internal. Sizes from 16 pitch, 1½" dia., to 1½ pitch, 48" dia.

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SPIRAL BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.

STRAIGHT BEVEL—Sizes from 16 pitch, 1½" dia., to 1½ pitch, 28" dia.

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WORMS AND WORM GEARS—Worms to 7" dia. Worm gears to 36" dia.

SPLINED SHAFTS — Lengths to 72".

DIFFERENTIALS — 3,000 to 750,000 inch pounds capacity.

GROUND TOOTH SPUR, HELICAL, AND SPIRAL BEVEL GEARS.

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Acoustics Research. In its operating position, SPAR is so stable in the water that its vertical motion is less than 1 fps. This reduces acoustical background interference during research by minimizing the intensity of water noise around the vessel's hydrophones. To reach an operating site, SPAR is towed horizontally by a tending tow ship which can remotely flood the research vessel's aft end, making it swing downward to depths of 300 ft. SPAR then floats vertically in the water with only 50 ft of its buoyancy section protruding above the surface. Research data collected with SPAR are relayed to the tending ship by means of electrical cables linking the two vessels. The research vessel is under development at the U.S. Naval Ordnance Lab., White Oak, Md.

• **LARGEST QUARTZ LENS** ever built has just been completed. The lens is 36 inches in dia, 6 inches thick at the center and weighs 350 lb. It will become a part of an optical solar simulation system, contained in a seven-story-high space environmental chamber. Special tools and handling devices had to be built for the large lens. Because of its thickness, diamond milling machines had to be retooled. Previously, large glass blanks handled on Bausch & Lomb's grinding and polishing equipment never exceeded 18 inches in dia and 3 inches in thickness. The most difficult part of preparing the plano-convex lens was said to be generating the precise convex curve. After the edges of the blank were trimmed to the proper diameter, the curve was milled. From there the lens went to a grinding machine for successive stages of polishing with several grades of garnet. The lens will be installed in a chamber which is pumped down to an extreme vacuum and used to test full-scale space vehicles before they are launched. The complete environment-testing system will simulate conditions of space hundreds of miles outside the earth's atmosphere. The quartz lens is a companion to one of optical-grade, boro-silicate glass. Present plans call for the glass lens to be used as a spare in case of damage to the quartz lens. Lens-supporting structures had to be designed to prevent the mirrors and reflecting surfaces from distorting because of their own large weights and stressing caused by temperature differentials. The resulting structure has been

LOOK AT WHAT YOU CAN DO WITH MODERN TORQ SPEED DETECTORS

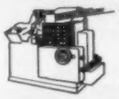
JET ENGINES

In event of overspeed, automatically actuate the control circuit. Torq speed switches for aircraft are temperature compensated, inherently balanced and produced to required military specifications.

SAW MILLS

Automatically withdraw cutting blade due to overload for any reason.

MACHINE TOOLS



Automatically brake and shift transmission at proper pre-determined speeds selected by push button.

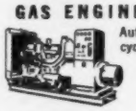
METER SCALES

Automatically switch scale ranges where rotary speed is a function of the measurement.

ELEVATORS

Cut in braking circuit if unit overspeeds, or falls below operating speed due to overload.

GAS ENGINE GENERATOR SETS



Automatically switch from cranking cycle and protect against overspeed.

DIESEL ENGINES

Switch out cranking motors, engage and disengage cooling circuit, supply varying fuel requirement, signal full speed.

TRUCK REFRIGERATORS

Maintain proper alternator output at all truck speeds by automatic shifting of alternator transmission at pre-determined truck engine r.p.m.

Torq speed detectors are small, snap-acting, rotary-centrifugal switches for actuating one or many circuits at one or more pre-determined speeds from 0 to 15,000 r.p.m. — they operate on speed only, independently of all other conditions — can provide up to 3 million cycles of uniform operation at tolerances to ¼ of 1% — are designed on a patented "friction-free" principle — and are available in a wide range of sizes, models and operating characteristics to meet practically any application.

Patents and Patents Pending

Write or phone for additional data.

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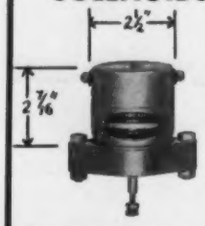
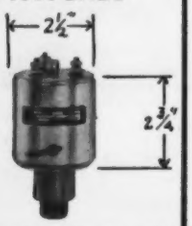
Synchro-Start

HEAVY DUTY D.C. SOLENOIDS



These solenoids are ruggedly constructed, having a life expectancy of over 2,000,000 operations at a rated capacity of 10 lbs. pull. They are available with ½, 1 and 1½ inch stroke.

SPEED SENSITIVE SWITCHES



An extensive line of speed sensitive switches, with various mountings and drives to suit the needs. One or more snap switches contained in a single unit can be furnished to trip at any given speed with an adjustable range for each.

SYNCHRO-START PRODUCTS, INC.
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IDEAS IN THE NEWS

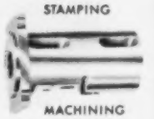
designed to permit continuous operation for months if necessary, simulating conditions of space which a vehicle would encounter on an extended trip. Under operating conditions, the lens will be subjected to a total force of about 7 tons. This pressure is caused by the full weight of the atmosphere on the top of the lens and a vacuum of 10^{-6} mm of mercury below in the test chamber. Planned operation date for the complete chamber is Dec. 15, 1961. The chamber was designed and fabricated for the jet-propulsion laboratories of Pasadena, Calif., and will be used to test the complete "Mariner R" space vehicle prior to a Venus shot in mid-1962.

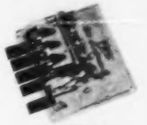
WORLD'S LARGEST QUARTZ LENS. Measuring 36 inches in dia, with 6-inch center thickness and weighing 350 lb, the giant glass will be part of a solar simulation system.

• **UNDERWATER SCINTILLATION DETECTOR** measures all beta and gamma radiation in the sea to depths of 1000 ft. The transistorized, battery-operated detector consists of a submersible detector probe, cable and readout package. The probe contains a 7-inch-dia plastic scintillation sphere with a nominal 20 mg/cm² waterproof coating, which detects the underwater radiation. The scintillator is mounted on a stainless-steel, waterproof, submersible probe containing a multiplier phototube, preamplifier and high-voltage supply. Adjustable weights provide easy submersion. The cable is a 1-inch diver's hose with a working strength of over 250 lb, providing mechanical and electrical connections to the probe. At the surface, the fiber-glass readout package is battery operated with its own builtin charger. Pulses sent up the cable are amplified and selected by the pulse-height discriminator. A differential or integral pulse-height

Stamped or Machined parts are EASY to Buy when DIEBEL does the job

STAMPING


MACHINING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WHY? . . . because our motto One Source—One Responsibility means that we will accept complete responsibility for the **entire** part—**all** the secondary operations, machining, forming, heat treating, finishing—even assembly . . . all done with precision workmanship, engineering and quality control.

Send your prints, ask for a sales engineer or write for brochure and facilities list.

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MAYLINE

Adaptable Drafting Furniture

METAL PLAN FILE

Mayline 5 Drawer Metal Plan File can be attached to a Mayline May-O-Matic drafting table. A file mounted on a table gives 5 drawers extra of filing space.

The May-O-Matic drafting table is entirely adjustable and counterbalanced. Has sliding reference top. Seven combinations available. For complete details on both products ask your dealer for folders S-20 and S-23.

MAYLINE CO., INC.
529 No. Commerce St.
Sheboygan, Wisconsin

MAY-O-MATIC "E" COMBINATION

MAYLINE

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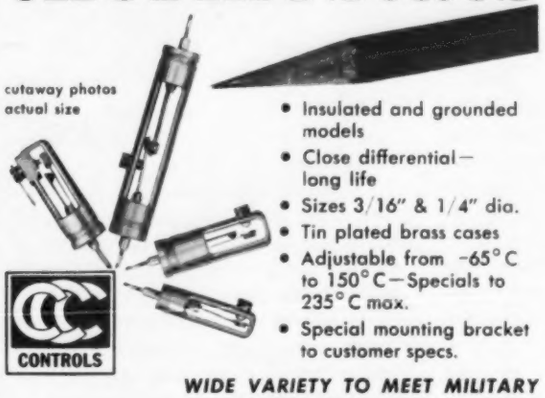
Quality... miniature & sub-miniature
Hermetically Sealed

thermostats



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- Special mounting bracket to customer specs.

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Illustrated here are the results of 25 years experience in the thermal control field. All Chatham Thermostats have a patented positive contact wiping action for longer life.

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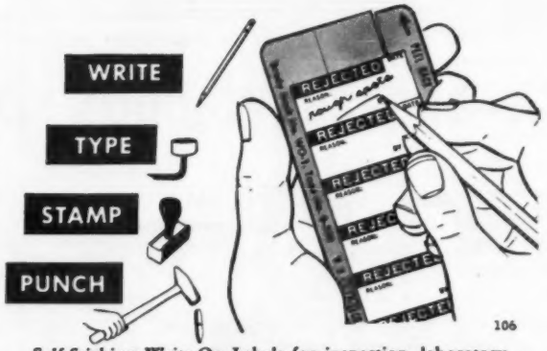
IDENTIFICATION MADE ON THE SPOT

BRADY Write-On
SELF-STICKING LABELS



Self-Sticking Write-On Labels for inspection, laboratory, maintenance, electrical and safety marking. Mounted on handy portable dispenser cards for on-the-spot use. Just add specific data to preprinted label form with pencil, pen, rubber stamp or typewriter. Over 100 stock items. Three label materials: Removable Vinyl Cloth, oil-proof Aluminum Foil, self-destroying Paper. Specials made to order. Write for bulletin 131 and free samples.

W. H. BRADY CO., 751 W. Glendale Ave., Milwaukee 9, Wisconsin
Manufacturers of Quality Pressure-Sensitive Industrial Tape Products • EST. 1914

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discriminator selects the pulse amplitude to drive a scaler. Having a 10^7 count capacity, the scaler provides the measurements of the total count. A count-rate meter, having full-scale deflections from 10^3 to 10^7 counts per minute, also is provided. The readout package also provides a 1-ma full-scale signal for operating standard portable recorders. The probe measures 22 inches long by 9 inches in dia and weighs 58 lb—35 lb in the water. The connecting cable weighs 1/2 lb per ft. The scintillation detector was designed and produced by Franklin Systems, Inc., West Palm Beach, Fla.

MEETINGS

Washington, D. C.
Jan. 9-11

NATIONAL SYMPOSIUM ON RELIABILITY AND QUALITY CONTROL, American Institute of Electrical Engineers, American Society for Quality Control, Institute of Radio Engineers and the Electronic Industries Assn. Statler-Hilton Hotel.

Philadelphia, Pa.
Jan. 22-25

NATIONAL PLANT MAINTENANCE AND ENGINEERING SHOW, Convention Hall.

Los Angeles, Calif.
Jan. 22-Feb. 1

ENGINEERING AND MANAGEMENT COURSE, University of California at Los Angeles Extension, UCLA Campus.

Princeton, N. J.
Jan. 24-26

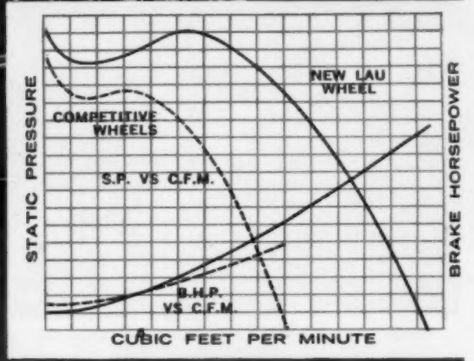
SECOND SYMPOSIUM ON THERMOPHYSICAL PROPERTIES, American Society of Mechanical Engineers, Princeton University.

St. Louis, Mo.
Jan. 29-31

SEMIANNUAL MEETING, American Society of Heating, Refrigerating and Air Conditioning Engineers, Chase-Park Plaza.

DO YOU NEED A
HIGHER EFFICIENCY
SMALL BLOWER
WHEEL?

GET INCREASED PERFORMANCE WITH THE NEW LAU [illegible] SPUN WHEEL



Lau Engineering has successfully developed a blower wheel that out-performs any wheel of comparable size tested. This powerful, compact unit is specifically designed for installation in room air conditioners but can be used effectively in most appliance applications. Lau "spun" construction contributes greatly to the wheel's structural rigidity and to a very high CFM to WATT ratio.

This new Lau wheel is offered in a customer's choice of aluminum, cold rolled steel or zinc grip and in a range of diameters, blade lengths, bore sizes and back plate designs.

LAU THE LAU BLOWER COMPANY
2027 Home Avenue Dayton 7, Ohio

Get this free engineering data file on the new Lau high performance appliance wheel.

Mr. Wm. H. Wentling, Director of Engineering
The Lau Blower Co., 2027 Home Ave., Dayton 7, Ohio

Please send me your engineering data file on the new Lau high performing wheel. ☐ We would like to see sample wheel.

Name_____

Position_____

Company Name_____

Address_____

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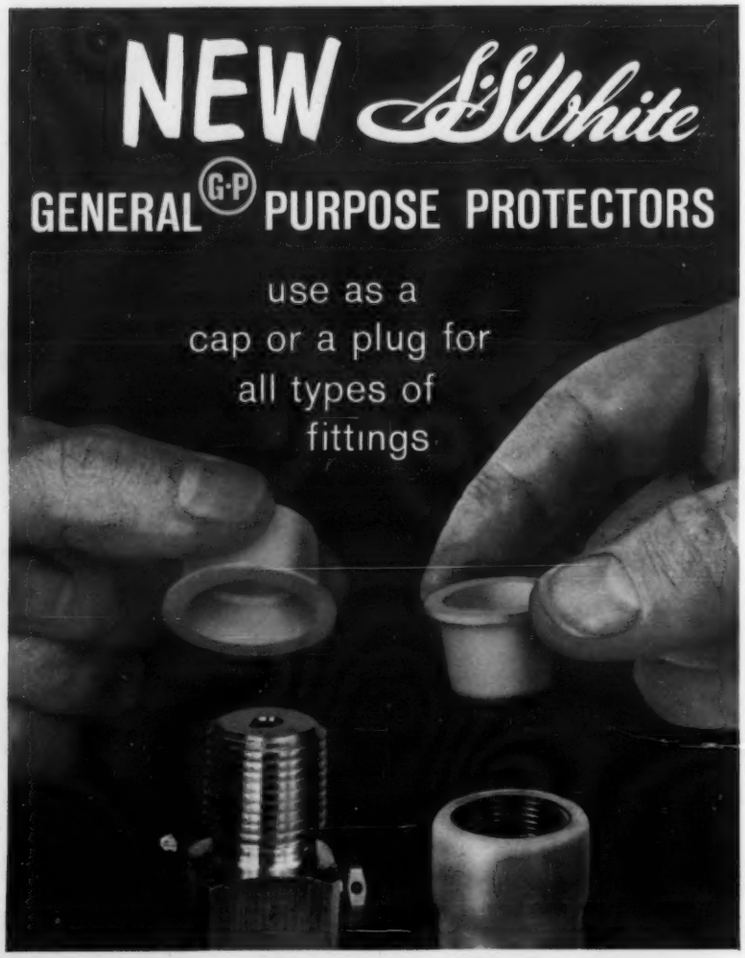

Eliminate special sizes...fit more accurately!

S. S. White General Purpose "GP" Plastic Protectors are an improved way to protect your products during manufacturing, shipping and storage.

Each GP protector can be used as either a cap or a plug on all machine screw threads, pipe threads, and tubing in a range from ¼" to 2¼"...with an accurate, *engineered* fit. GP protectors eliminate special sizes and fit better!

"GP" protectors are made of a special grade of elastic polyethylene that cushions shock and is unaffected by oils, greases, acids and other common solvents. They have a "stay-put" fit, yet they are easy to grip for a quick, *non-shredding* removal.

Start now to *put an end* to customer complaints about damaged equipment. Use low cost GP protectors!

WRITE FOR BULLETIN 6104-GP
Complete details

S. S. White **PLASTICS DIVISION**
Dept. 26P 10 East 40th Street, New York 16, N. Y.

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Forty-Year Forecast

Taking a long, optimistic look at the future, Chris J. Witting, vice-president in charge of the consumer products group at Westinghouse Electric Corp., forecasts many advances that may make home life in 2000 vastly different than it is today:

. . . Interlocking room units that can be buckled onto a house as the family expands, then unbuckled and presented to the occupants when they grow up and leave home, may be in common use some 40 years from now.

. . . Outdoors, electronic wands will keep the bugs out of the yard. Heating elements attached to trees and outer walls will make the yard usable on chilly evenings. No patio will be complete without electroluminescent panels that heat, cool and light the area.

. . . Two tiny wireless pellets, placed in the ears, will give each member of the family a portable, personalized high-fidelity stereo speaker system.

. . . Clothing worn during travel will feature lapel dials that can be adjusted to increase or decrease the output of thermoelectric temperature controls built into the garments.

. . . Clothing will be washed and dried by ultrasonic energy. Closets will include equipment to clean suits and dresses. Hang them up at night, and they will be cleaned, pressed and ready to wear next morning.

. . . Shoes will be cleaned automatically by door mats with automatic air streams.

. . . Miniature devices enclosed in window shades will clean windows ultrasonically when the shades are raised and lowered.

Which Way Is North?

About 600,000,000 years ago, the North Pole was located in the South Pacific. Since then, it has wandered throughout the Pacific Ocean, eventually reaching its present position.

The rivers of the world are the main reason causing the poles to shift, according to Dr. George W. Bain, Amherst College geology professor. The spinning earth, acting like a gyroscope, shifts position when it becomes "top-heavy" in certain areas.

Rivers wearing down mountainous land transfer large masses of weight from one area to another. During a period of millions of years, the transplanted weight causes the poles to shift.

Periods of upheavals, erosion and shifting poles have been continually recurring throughout the earth's history.

The process of erosion is now going on in southern Asia where the Indus, Ganges and other rivers are wearing away the Himalaya Mountains and dumping the load of sediments into the nearby seas. This shifting weight will eventually shift the North Pole deeper into Canadian territory, bringing the cold Arctic weather to Montreal, Quebec and other Canadian cities.

However, it should cause no great concern in the immediate future for this will not happen for quite a few million years.

Hey, Joe! Want to see something funny?

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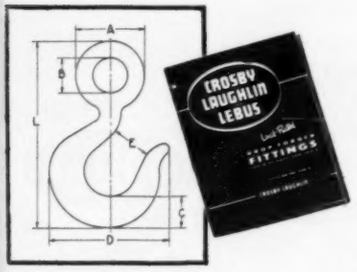

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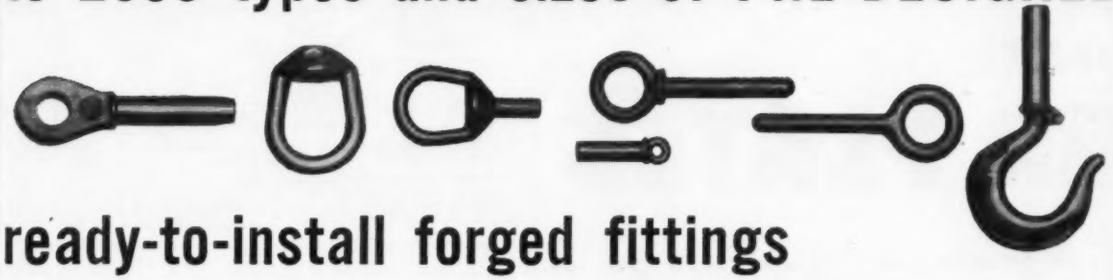

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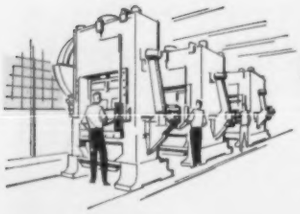

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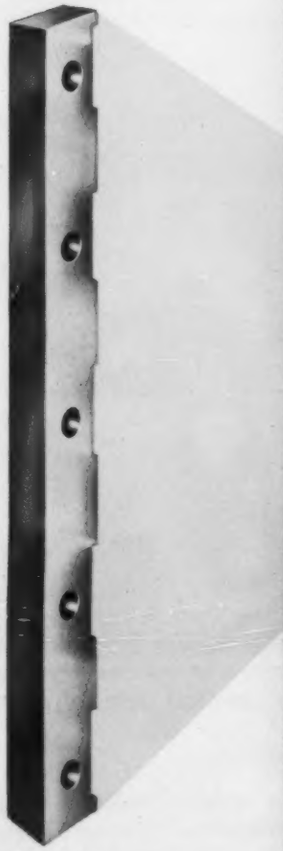

LAMINA-BRONZE WEAR PLATES

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DIES AND TOOLS, INC.
P.O. BOX 31; ROYAL OAK, MICHIGAN
Phone JOrdan 4-8711

Lamina-Bronze Wear Plates and their use are more completely described in Bulletin WP-59, send for your free copy.

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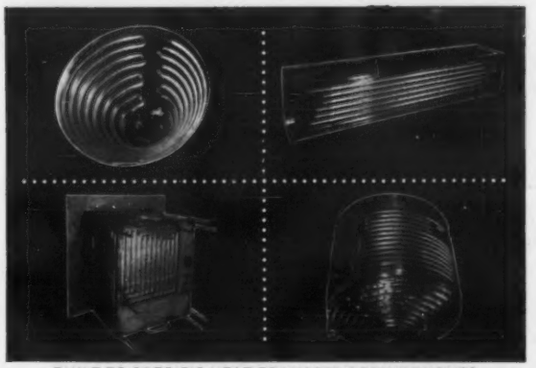

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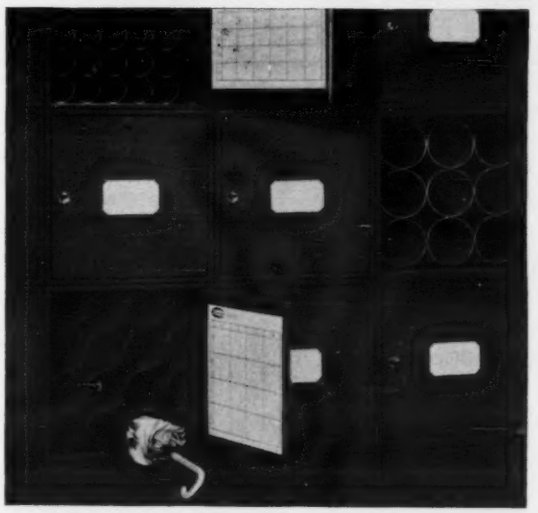

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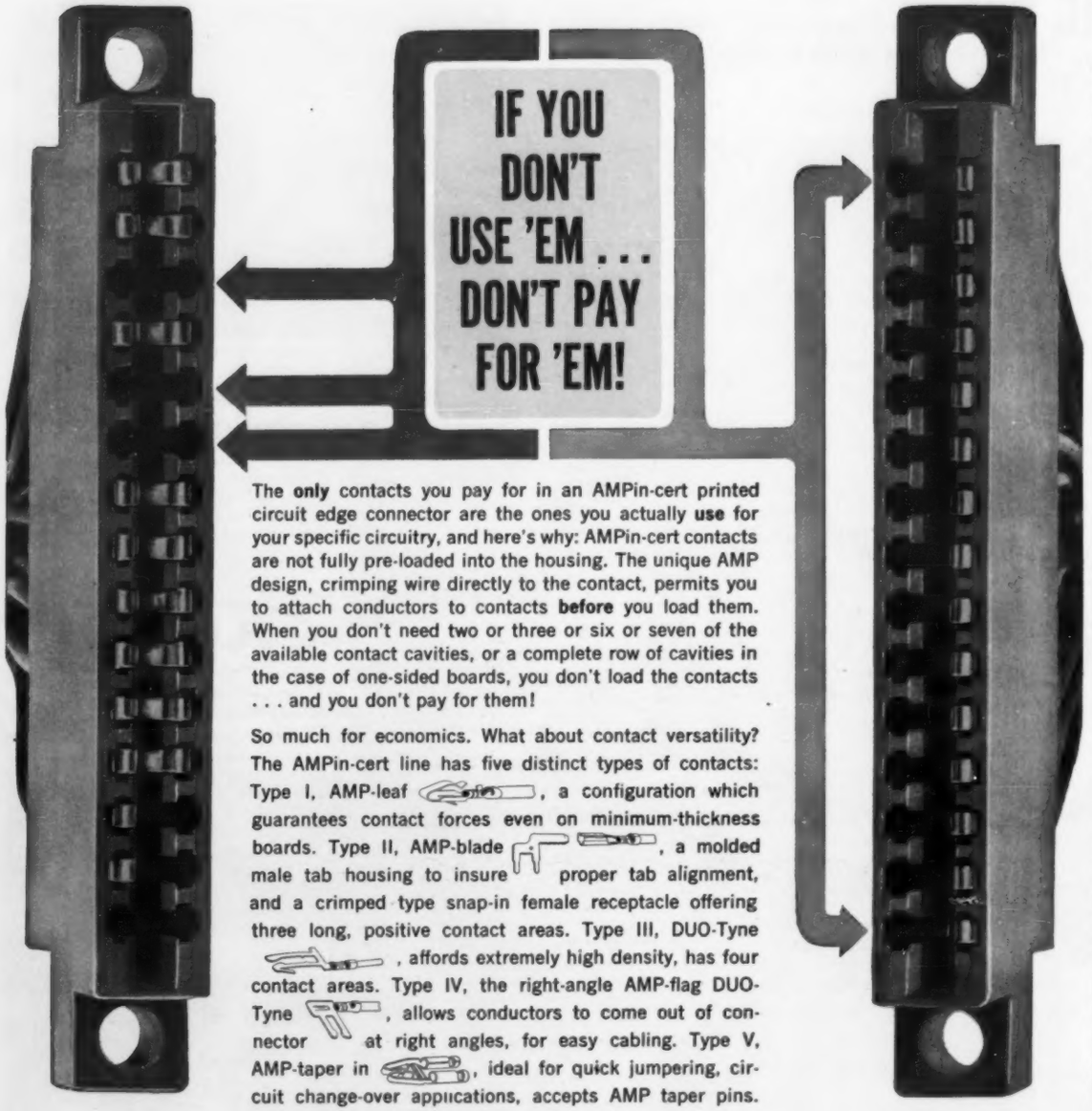

IF YOU DON'T USE 'EM . . . DON'T PAY FOR 'EM!

The **only** contacts you pay for in an AMPin-cert printed circuit edge connector are the ones you actually **use** for your specific circuitry, and here's why: AMPin-cert contacts are not fully pre-loaded into the housing. The unique AMP design, crimping wire directly to the contact, permits you to attach conductors to contacts **before** you load them. When you don't need two or three or six or seven of the available contact cavities, or a complete row of cavities in the case of one-sided boards, you don't load the contacts . . . and you don't pay for them!

So much for economics. What about contact versatility? The AMPin-cert line has five distinct types of contacts: Type I, AMP-leaf, a configuration which guarantees contact forces even on minimum-thickness boards. Type II, AMP-blade, a molded male tab housing to insure proper tab alignment, and a crimped type snap-in female receptacle offering three long, positive contact areas. Type III, DUO-Tyne, affords extremely high density, has four contact areas. Type IV, the right-angle AMP-flag DUO-Tyne, allows conductors to come out of connector at right angles, for easy cabling. Type V, AMP-taper in, ideal for quick jumpering, circuit change-over applications, accepts AMP taper pins.

Quality? AMPin-cert is quality, in the contacts and the housings:

- Contacts are phosphor bronze, gold over nickel plating
- Contacts accept single, multiple leads, and "snap-in" the housing without insertion tools
- Contacts are recessed in housing—no post insulation required
- AMPin-cert connectors will accept one-sided and two-sided boards

Ask us for the full AMPin-cert printed circuit connector story.

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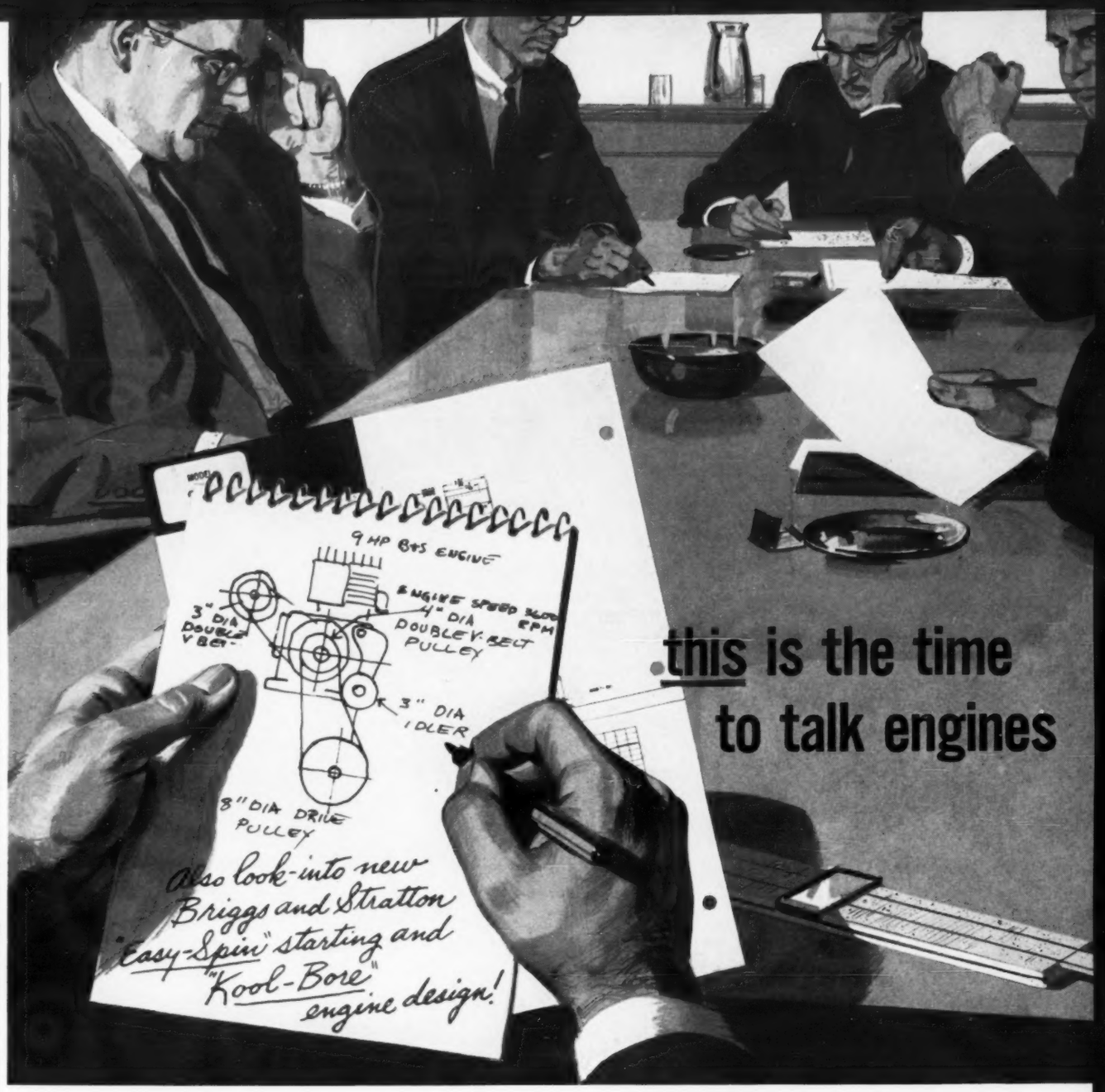
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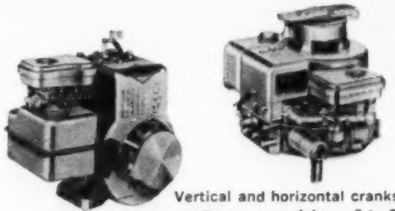

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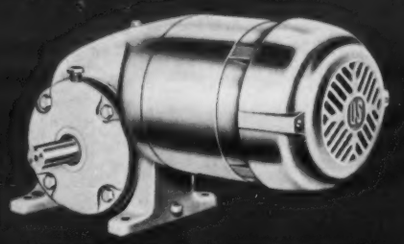

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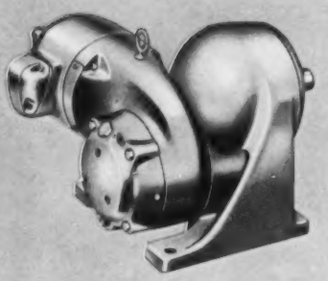
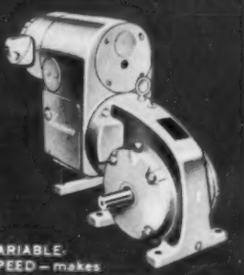
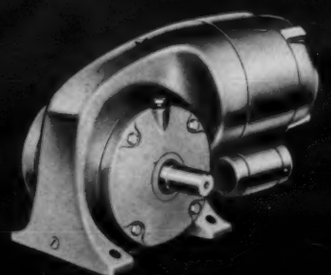


DOUBLE-REDUCTION (GWB)—ratios up to 354:1—with second stage helical gear train—provides steady, multiplied torque and extremely slow speeds for applications in which power-speed precision is important. High-torque case is constructed to resist extra pull.



VARIABLE-SPEED—makes instant speed changes by merely turning dial—Combination of GW Syncrogear with U.S. Varidrive Motor to provide speed control with worm-gear reduction.



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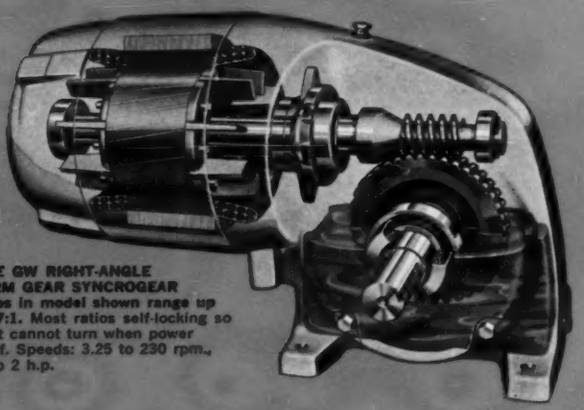

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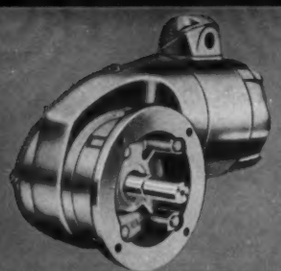

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